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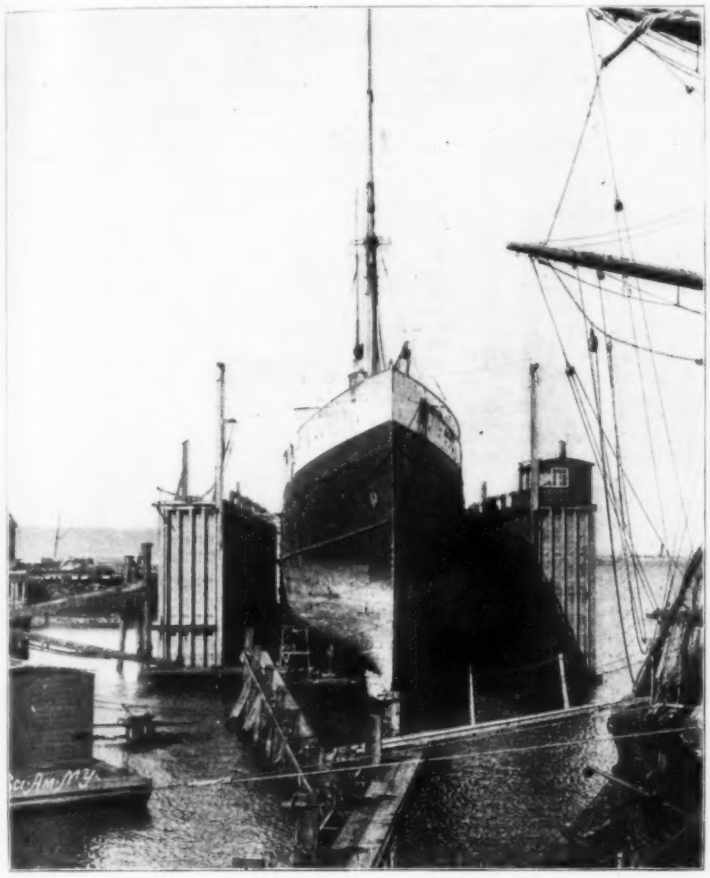
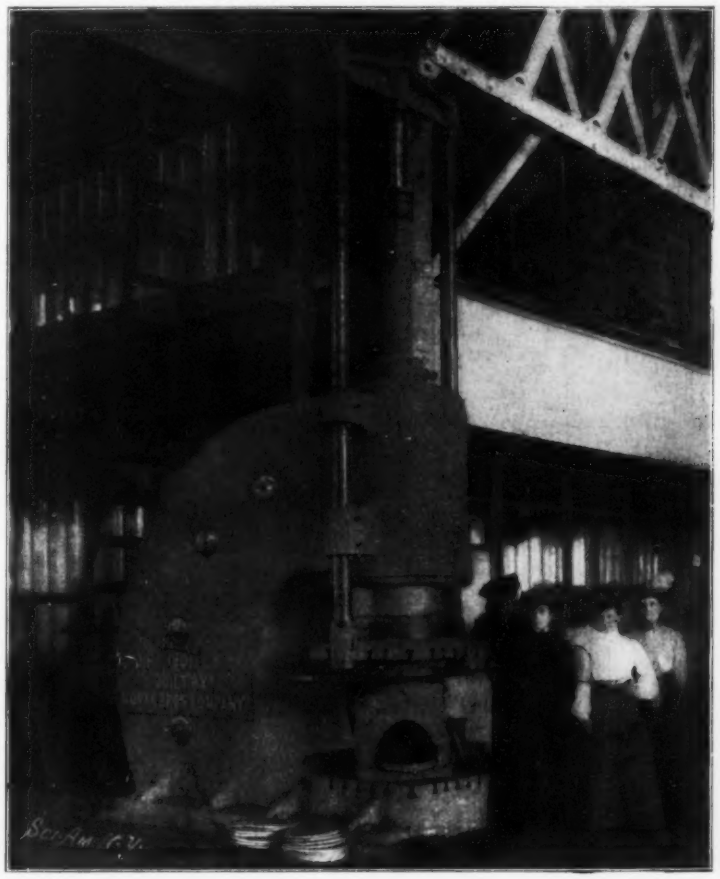
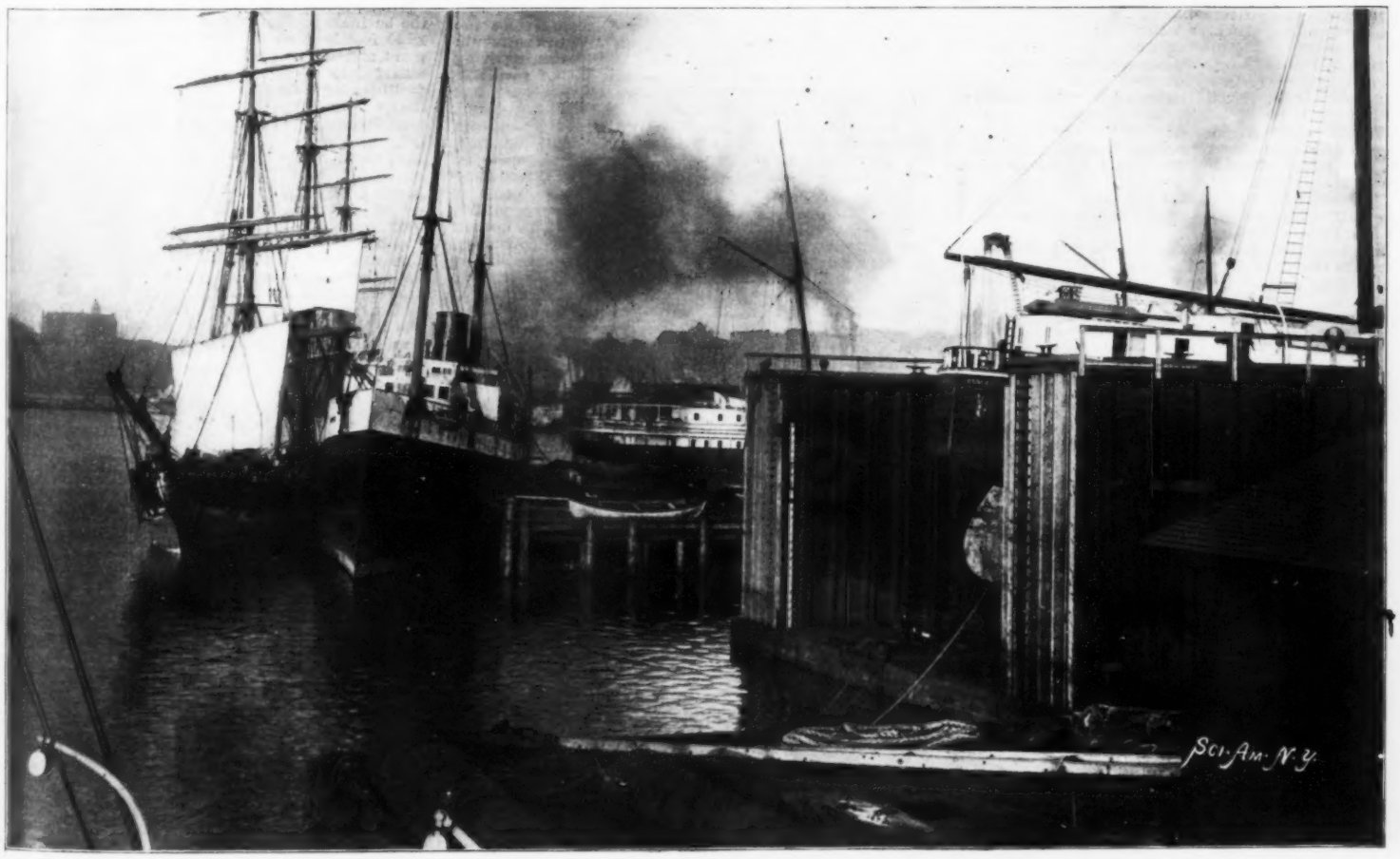


A 3,000 TON SHIP ON THE MORAN COMPANY'S DRYDOCK.



A 1,000 TON HYDRAULIC PRESS.



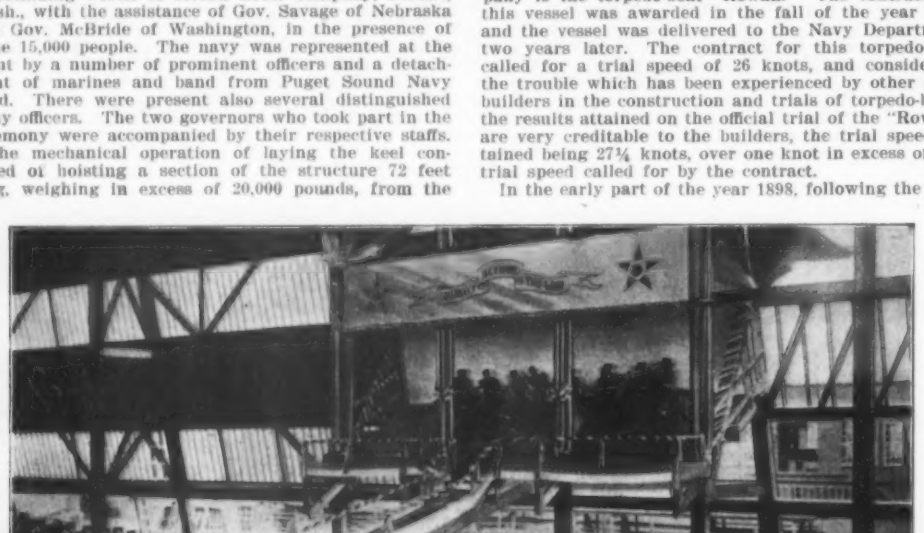
VIEW SHOWING FLOATING DRYDOCK AND GROUP OF PACIFIC COAST STEAMERS UNDERGOING REPAIRS.

BUILDING OF THE BATTLESHIP "NEBRASKA" AT A PACIFIC COAST YARD.

LAYING OF THE KEEL OF THE NEW BATTLESHIP "NEBRASKA" AT THE WORKS OF MORAN BROS. COMPANY, SEATTLE, WASH., JULY 4, 1902.

THE keel of the new battleship "Nebraska" for the United States Navy was laid on July 4, 1902, at the shipbuilding works of Moran Bros. Company, Seattle, Wash., with the assistance of Gov. Savage of Nebraska and Gov. McBride of Washington, in the presence of some 15,000 people. The navy was represented at the event by a number of prominent officers and a detachment of marines and band from Puget Sound Navy Yard. There were present also several distinguished army officers. The two governors who took part in the ceremony were accompanied by their respective staffs.

The mechanical operation of laying the keel consisted of hoisting a section of the structure 72 feet long, weighing in excess of 20,000 pounds, from the shop floor to an elevation of about 20 feet and carrying the same in mid-air to the proper point over the keel blocks on which it was lowered, the entire operation consuming less than five minutes. A rivet was then driven by the two governors, each removing his coat and rolling up his sleeves for the purpose.



GOVERNORS SAVAGE OF NEBRASKA AND M'BRIDE OF WASHINGTON LAYING THE KEEL OF THE "NEBRASKA."

The battleship "Nebraska" is one of the five vessels the construction of which was authorized by Congress two years ago. These vessels are of the following dimensions, viz.: Length between perpendiculars, 435 feet; length over all, 441 feet 3 inches; breadth molded, 76 feet; breadth extreme, 76 feet 2½ inches; mean draft, 23 feet 9 inches; displacement, 15,000 tons. The main battery of these vessels is to consist of four 12-inch breech-loading rifles, eight 8-inch breech-loading rifles, and twelve 6-inch breech-loading rapid fire rifles.

Of the five battleships above mentioned four are being built in Atlantic coast yards, the "Nebraska" by Moran Bros. Company.

The laying of the keel of the "Nebraska" marks an epoch in the shipbuilding industry of the Pacific Northwest. Seattle is a city on Puget Sound barely fifty years old. Moran Bros. Company's plant had its beginning twenty-two years ago. The success and rapid growth of this plant is the remarkable result of the enterprising spirit of a few men. These men were seven brothers, of whom, it is to be regretted, but four remain, three having died during late years. The first steel vessel built in the State of Washington was launched from their yard during the year 1896. Since that time a number of such vessels have been built at their establishment as well as a number of other classes of vessels, sail and steam, for ocean, sound and river service.

Among the naval vessels turned out by this company is the torpedo-boat "Rowan." The contract for this vessel was awarded in the fall of the year 1895 and the vessel was delivered to the Navy Department two years later. The contract for this torpedo-boat called for a trial speed of 26 knots, and considering the trouble which has been experienced by other shipbuilders in the construction and trials of torpedo-boats the results attained on the official trial of the "Rowan" are very creditable to the builders, the trial speed attained being 27¼ knots, over one knot in excess of the trial speed called for by the contract.

In the early part of the year 1898, following the gold discoveries in Alaska, this yard undertook to build, including hull, machinery and equipment, and deliver at the mouth of the Yukon River at the time of opening of navigation on the river, twelve steamers each 200 feet long. The construction and thorough equipment of these vessels were accomplished in a period of five months, construction having begun in January, and the twelve vessels being ready for steam before the first of June. These vessels were taken to the mouth of the Yukon River under their own steam, arriving there in time to do good service during the open season, and they are even now considered to be the best vessels on the river.

New power tools, many of which were designed especially for this plant, have lately been installed, among which, and most remarkable, is an immense hydraulic press designed and built by Moran Bros. Company. This press is used for large punching, flanging, etc. Connected to the hydraulic pressure intensifier, this press exerts a power of 1,000 tons, and, by reason of its open gap type, has a large range of application.

The ship-shed in which the present battleship is being built crosses the main shop at right angles. This shed is 920 feet in length, with the shipbuilding slip in the west end; the east half with adjoining buildings are the ship fitting shops, equipped with power tools. Service for handling material in this shed is given by two electric high-speed traveling cranes, each spanning one-half the width of the shed. A central electrically-driven trolley is also being installed, giving independent service along the middle of the shed. These cranes and trolley at a high elevation cross without interference and with more than ample working space over the regular shop traveling cranes, giving the ship-shed hoisting appliances uninterrupted travel from the extreme east end of the shed to the west end, their combined working range covering the entire ship-shed floor, and with the invaluable advantage of the working range these cranes and trolley have over the main shops at the place of intersection of the ship-shed with these shops the facilities for handling materials in ship construction will be unequaled; it might be said that the battleship now being constructed is set up in the shop. An examination of the accompanying illustrations will bear this out.

This plant also includes a modern sawmill, where the unexcelled Puget Sound timber and imported hard woods are manufactured into dressed lumber for all purposes. This department of the plant includes the sawmill proper, where logs up to 8 feet in diameter and 125 feet long can be cut into large or small lumber; also planing mills, steaming plant and dry houses. Spars of the largest diameter, made of faultless timber, are turned out in this mill.

With the refuse from the sawmill steam power is generated for the operation, aside from the mill itself, of hydraulic, electric and compressed air power plants.

Electric current is used for the operation of shop tools and all large tools are fitted with independent motors. A number of portable appliances are also operated electrically. Pneumatic tools are in use throughout the works for innumerable purposes. Hydraulic power is applied to flanging and punching appliances, also to riveters. The large forging hammers, generally called steam hammers, are operated here with compressed air. Only modern appliances are in use, it having been the aim of this company to surpass in point of equipment and convenience of arrangement any plant in existence.

The company has long had in operation a marine railway on which vessels up to 15,000 tons have been docked. Last year saw the addition to the plant of a floating drydock of 3,000 tons capacity. This dock is shown in operation by an accompanying photograph with one of the Alaska passenger steamships on the blocks. A new drydock and floating derrick combined is under construction, the derrick being designed for lifting heavy machinery, ordnance, etc., in outfitting vessels. The derrick will have a lifting capacity of 100 tons and will be operated by electricity.

A number of photographs accompany herewith, showing special tools in use at this works and arrangement of machinery in the various shops.

Aside from the battleship "Nebraska" there are under construction by Moran Bros. Company one steel lighthouse tender steamer, the "Heather," 175 feet long, and two steel tugboats, each 90 feet long. There is on hand also a large amount of general vessel repair work, which is a large proportion of their business. The works as now operated comprise, aside from the ship-shed and ship fitting shops above described, a blacksmith shop equipped for the heaviest forgings, a boiler shop in which boilers of the largest size are built, a machine shop equipped for a large output of small and large work, a pipe and copper shop in which are produced sheet metal and pipe work of all descriptions, a pattern shop, brass and iron foundries, where castings of size representing 50 tons can be made. The steel shipbuilding shops include large bar and plate furnaces.

This plant is located on a deep water frontage in the business portion of Seattle. Water frontage nearly 1,000 feet long on the face of property, together with piers and waterways, give the plant nearly a mile of wharf face for berthing vessels; hence the docking facilities and frontage are ample for the accommodation of a large number of vessels, there being at times as many as ten vessels of large dimensions undergoing repairs.

A heavy crane of the shear leg type, of lifting capacity 100 tons, is operated for the purpose of handling heavy weights in and out of vessels.

The railroad connections to this works are also very conveniently arranged. Cars loaded with shipbuilding material are delivered into the yard, where they are weighed on track scales of 100 tons' capacity and there unloaded by means of electric traveling cranes. Spurs from the main railroad tracks extend to the deep water wharves, one of these passing under the 100-ton crane already described, enabling the handling of heavy weights directly to or from the cars and vessels.

IN THE BLACKSMITH SHOP.

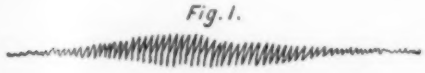
MARINE BOILERS IN THE BOILER SHOP.

BUILDING OF THE BATTLESHIP "NEBRASKA" AT A PACIFIC COAST YARD.

EXPERIMENTS ON RAILWAY AND ROAD BRIDGES.

THE chief points of difference, few as they are, which distinguish railway from road bridges are sufficiently marked in their action to produce results which have little or nothing in common pertaining to both types of structures. In the former the live load is greatly in excess of that carried by the road design, and so also is the speed at which it travels. The combined effect of these two disturbing causes is therefore considerably more accentuated in the first than in the second class of bridges. One of the best methods of ascertaining the general results attending the transit of traffic over a bridge, with respect to vibration and shock, is by the use of recording or registering

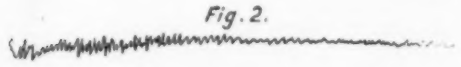
Fig. 1.



diagrams. Some interesting and instructive experiments have been made in this direction by M. Rabut, Ingénieur en Chef des Ponts et Chaussées, from whom we quote in the present article.

The diagram, Fig. 1, was taken at the bridge of Asnières during the passage of an express train. This structure carries four tracks, which rest upon five parallel girders. In the diagram the action of the passing load is rendered manifest by a succession of lines occurring very abruptly, but without any regular or periodic intervals. The deflection proceeds by uniformly increasing and subsequently by uniformly decreasing, the diagram terminating by several vibrations and oscillations, which quickly disappear. The second diagram—Fig. 2—represents the effect of the ordinary traffic, consisting of omnibuses, vehicles, and foot passengers upon one of the arches of the bridge des Saints-Pères, at Paris. It will be seen that the deflection changes very gradually. The oscillations at the time of the experiments were perfectly isochron-

Fig. 2.



ous, at the rate of four to the second. Their form is regular but sinuous, and their amplitude varies similarly to the deflection with the disposition and arrangements of the loading. This particular diagram is common to all road bridges, the only difference consisting in the period of the oscillations, and the maximum amplitude of the mean deflection. Another experiment was made on the bridge Jean François Lépine, which passes over the Great Northern Line, and has a span of 132 feet. The roadway is carried on jack arches, which would tend to render it more than ordinarily solid and rigid. The diagram in Fig. 3 was obtained from the passage of two steam rollers over it, weighing 30 tons each. When only one roller was used the diagram obtained was that represented in Fig. 4. In a subsequent trial of the same bridge, a number of men, weighing in all about a ton, passed over it in quick, regular steps, and, as seen in the

Fig. 3.

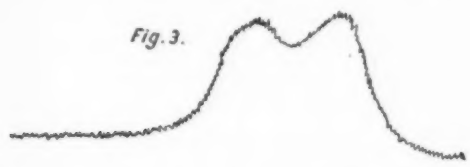
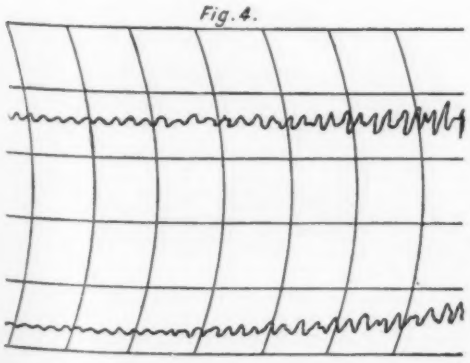


diagram in Fig. 5, the maximum deflection produced by the vibrations was in excess of that due to the passage of the roller. M. Rabut hence observes that there is danger in the event of any road bridge, no matter how strong it may be, being exposed to rhythmic shocks, even with a light loading. So far as English road bridges are concerned, except those belonging to the suspension type, we do not share those fears. It must be a very lightly built, poor sort of arch or girder bridge that will not withstand without fear of accidents a live load of this amount.

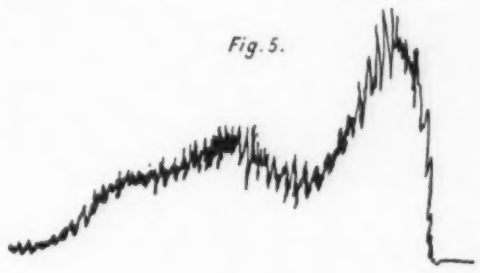
The influence of rail joints upon bridges has been known and acknowledged for a long while, but little attention has been paid to arriving at an exact investigation of the whole question. The following experiment upon a bridge, 14 feet in span, is instructive. A small example was chosen purposely, in order

Fig. 4.



to render the effect of the shock more appreciable, since it varies in the inverse ratio of the mass acted upon. A train was run over a rail joint of ordinary aperture placed at the center of the girder, at a speed of fifty miles an hour, with the result that the static deflection was increased three-fold. When the opening of the joint was entirely suppressed, the static deflection was still doubled. An increase of the opening to a little over one inch produced a deflection five times that due to the static load. It may be mentioned that these proportions are not mathematically correct, but they indicate the drift of the test. The objection

Fig. 5.



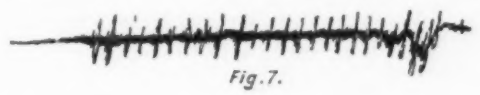
to dispensing completely with rail joints, either by electrically welding the rails together or rolling them of sufficient length, is supplied by the engineers' chief bugbear, expansion and contraction. Against this view of the matter, it is contended that the expansion of the rails is more specious than real, and is compensated for by the corresponding expansion of the me-

Fig. 6.

tallic flooring. This statement is partially but not entirely correct, either in principle or practice, for the rails heat at a more rapid rate than heavy massive girders.

A series of experiments conducted to obtain diagrams for the passage of a train over a rail joint on the bridge of Argenteuil, affords some excellent and suggestive results. The first trial was made upon a joint supported on a cross girder. A train drawn by a Heilmann electric locomotive, with two sets of four axles placed very closely together, constituted the moving load. In Fig. 6 is a representation of the diagram produced by the load running over the joint at a low speed. The two camel-like bosses indicate the successive transit of the two groups of axles. At a high speed the effect is delineated in the diagram in Fig. 7, which is altogether dissimilar to the former.

Fig. 7.



In the one instance the almost insensible vibrations are replaced in the other by oscillations equal in intensity to the deflection. It was found that the stress upon the cross girder was doubled by these brusque oscillations. A diagram showing the effect of the moving load when the joint is placed over a rail bearer is given in Fig. 8, which is of marked significance. The train consisted of an engine hauling a large number of wagons. The deflection produced is but just appreciable, but the effect caused by the rail joints is fully displayed by the vertical lines, which in the diagram intersect the horizontal lines. Each of these lines represents the shock occasioned by the passage of a wheel over a joint, and the sudden increase of the stress upon the rail bearer is very apparent. These experimental diagrams demonstrate the difference that exists between the effects of road and rail traffic upon bridges, or, in other words, upon bridge floors, which in the one case are subjected to elastic vibrations, and in the other to abrupt oscillations. Similar results, but of a more serious character, have been

Fig. 8.

found to attend the action of wheels in which a certain part of the tires had become flattened. Rails have been frequently broken in this manner. As an example, an engine running from Paris to Limoges, broke in one night a hundred rails on one side of the track, and in returning fractured fifty upon the other side. Upon examination one of the wheel tires was found to be greatly flattened at a certain part.—The Engineer.

WATER POWER USE IN UTAH.

A REPORT from G. L. Swendsen, engineer in charge of the hydrographic investigations of the United States Geological Survey in Utah furnishes facts in connection with the development of irrigation and the use of water power in that State. The systematic measurements which have been carried on for several years on the larger streams by the Geological Survey to ascertain their fluctuations and especially their low-water flow, demonstrated that the point has been reached in the use of the water resources of the State where a general conservation of the flood waters in storage reservoirs is necessary for further development of irrigation or the use of power.

Measurements of the Bear River, which flows through a fertile valley in Northern Utah, showed that the volume of water which flowed into Great Salt Lake in the last summer season was exceptionally low, less than one-half that of any previous record. The fact is thus established that the low water flow of this river will be insufficient for the large irrigating canals now being built to take water from it, and that some means of conservation will be necessary to provide for them.

A number of other streams in the State reached this point some years ago, but in addition to the irrigation interests on some of them, such as the Logan, Provo and American Fork, valuable water power interests are being developed which require for their success and growth an increase in the low water supply of these streams. This, together with the increased needs of irrigation development, has recently aroused great interest in reservoir investigations at the headwaters of the Logan, Blacksmithfork and Provo rivers, and in a general increase of the available water supply throughout the State.

COMPENSATION FOR THIS AGE OF HUSTLING.

To point to the hurry and stress of modern town life as the cause of half the ills to which flesh to-day is heir has become almost a commonplace in etiological diagnosis. The old-fashioned complaints might almost excite a medical man's pity, so much do they seem to be crowded out by those active widespread young fellows, neuritis, neurasthenia and a whole young family of nervous illnesses, the offspring of the strained existence of to-day. A chain is as strong as its weakest link, and to-day it appears that the nervous system is the weak link of the organism. The weakness is not natural. It is acquired because the strain upon this link is so often almost constant and out of proportion to the wearing power of the material. Whether as generations advance individual nervous systems will more easily bear the labors asked from them or not, at any rate it may fairly be assumed that in the early days of any new style of life the generations born under an old régime have the worst of it. Their children cope more easily with the new necessities. They are earlier confronted with them, and new arrangements which perplexed and worried their parents become habits easily borne and therefore not to be reckoned among the trying elements of existence.

Thus we may imagine future generations perfectly calm among a hundred telephones and sleeping sweetly though airships whizz among countless electric wires over their heads and a perpetual night traffic of motor cars hurtles past their bedroom windows. As yet, it must be sorrowfully confessed, our nervous systems are not so callous. Some of us still start at the telephone ring and find the irregularities of the instrument a source of irritation and worry. Many of us are actually nervous at the sudden appearance of a motor car round the wrong side of a London street corner. The result of countless repetitions of these trials, small though they may be singly, is not to be lightly estimated.

Fortunately, the very causes of nerve exhaustion, so far as improved rapidity of locomotion may be counted one of them, provide one important counteracting feature of town life at the present day. We are alluding to the facility with which those whose week days are spent in city toil may spend the seventh in breathing the fresh air and beholding the innocent joys of the rustic. To the hard-working Londoner the value of the week-end properly used is hard to overestimate. From the eager broker and worried business man to the stifled seamstress and toiling artisan there are few who cannot find further or nearer from the metropolis some fresh and open spot where they may replace the evil atmosphere of the office or the factory. Without trains, electric tramways and motor cars such a wholesome change of scenery and surroundings would be scarcely possible in the limited time available.

We do not wish to underrate for a moment the value of parks and open spaces—the "city's lungs." For many these afford the only possibility of a Sunday in at any rate comparatively fresh air. Those large numbers, though, who habitually find the Sabbath's rest in a day's wholesome exercise at some little distance from their work-a-day center may spare a moment from the usual condemnatory attitude toward the bustle, rush and clatter of up-to-date locomotion to bless the means which enable them so profitably to enjoy the day.—The Lancet.

GRAY HAIR AND EMOTIONAL STATES.

DR. HARRY CAMPBELL, writing to the Lancet, in reference to the article on this subject in that journal for March 1, by Dr. Robert Jones, agrees that "abnormal grayness is an infallible index of some defect in the nervous system." He says: Between the normal and the abnormal there is, of course, no sharp dividing line—the one runs imperceptibly into the other—but, speaking generally, we may say that the chief features of normal grayness are: (1) It does not come on before, say, the age of thirty-five years; (2) it is symmetrical; (3) it begins in certain regions, preferentially the temples (so named on account of this very fact), spreading thence; (4) the blanching progresses gradually; (5) the blanching on the scalp does not proceed decidedly in advance of that on the face.

We are now in a position to give the features of abnormal grayness: (1) Premature blanching of the hair is the most important sign of it, and the earlier the grayness appears the greater the abnormality—thus it is greater in one who turns gray in his twenties than in one who does not begin to go gray till in his thirties; (2) asymmetrical grayness is so well recognized to be due to defective nervous action that I need not further insist upon the fact; (3) grayness which does not begin in symmetrical foci spreading thence, but affects the whole scalp or beard equally in all its parts, is, unless it progresses slowly, generally abnormal; (4) rapid blanching is always abnormal; and (5) when the whole of the hair on the scalp is decidedly gray, while that on the face retains its color completely, the condition is abnormal. We may frequently observe this condition in men in their early thirties or early forties. I have never observed the exact converse of this, though it is quite common for men to grow more rapidly gray in the beard than in the scalp; this I do not regard as abnormal.

THE MERAY-ROZAR ELECTROTYPOGRAPHIC MACHINE.

ALL the composing machines now in use have two great drawbacks that unfit them for the execution of certain kinds of work. In the first place, justification as accomplished with these machines is rather irregular, or, at least, not easily enough performed, and the result is that very fine work cannot be done with

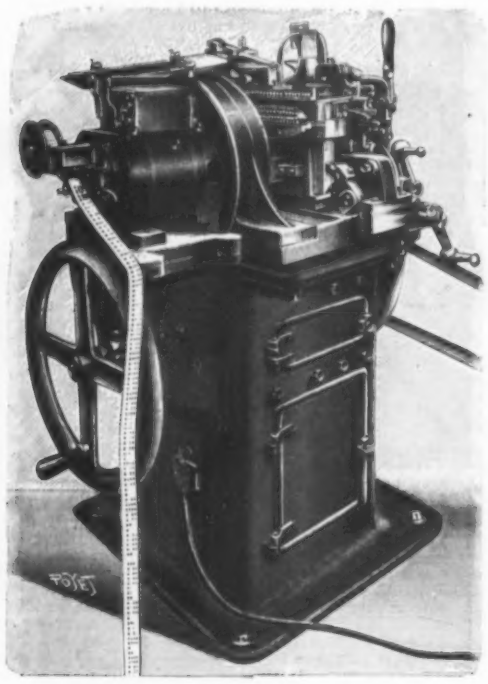


FIG. 1.—THE MERAY-ROZAR COMPOSING MACHINE.

them. Otherwise they certainly operate well enough, but from the viewpoint of fine work, composition by hand is preferable. In the second place, correction is an operation that is relatively expensive with the machines at present employed, and the cost of it, as regards newspapers especially, sometimes amounts to a third of that of the compositon, which has to be done over again line by line.

The "Electrotypograph," invented by M. Meray-Rozar, of Nuremberg, possesses none of these inconveniences. It justifies automatically, or mathematically rather, and offers the greatest facility for corrections. It is a double machine, or, more accurately speaking, there are two distinct machines combined in one. One of these is a writing and the other a casting and composing machine. The operation of each is equally perfect.

The writing machine (Fig. 4) performs two different operations that are effected with a single keyboard, the manipulation of which requires no expenditure of strength. These operations are: (1) The reproduction, upon a sheet of paper, of the copy in the ordinary characters of the typewriting machine; and (2) the forming of a series of perforations upon a paper ribbon which unwinds as fast as the keys are struck. The reproduction of the copy may be read by the operator as he writes, and it is thus possible for him to ascertain at any instant whether or not he has made a mistake. As for the perforations made upon the ribbon of paper, they are so arranged as always to form the different combinations necessary for representing: (1) All the lower case letters, (2) all the capital letters, and (3) all the figures and punctuation marks employed in ordinary typography.

It is this perforated ribbon which, unwinding hour after hour upon the composing machine, permits the latter to read mechanically, so to speak, the copy which it materializes. The ribbon comprises eight longitudinal rows of apertures which may be designated by the numbers 1, 2, 3, 4, 5, 0, 6 and 7.

The row designated by 0 is perforated the whole length of the ribbon and serves solely for moving it forward upon the composing machine. The numbers 1, 2, 3, 4 and 6 serve for all the combinations of lower case letters. Thus, the apertures 3 and 4, placed alone in a transverse row, represent the letter *b*. Aperture 7, formed upon the same transverse line as one of the preceding combinations, shows that the letter is a capital. A transverse row comprising the apertures 3, 4 and 7 represents the capital letter *B*. Finally, aperture 6 indicates that a mark or point is concerned, and so a row composed of the apertures 3, 4 and 6 represents such mark or point.

All the apertures are formed mechanically by means of a punch, and are thus perfectly clean-cut. All that the operator has to do is, by pressing the proper key, to disengage the rod upon which is mounted the punch corresponding to that key. A small electric motor then produces the power necessary to effect the perforation.

The bands are thus perforated with holes that correspond to the different letters of the alphabet. But the machine does still more, for it automatically effects the spacing of the letters, that is to say, registers the thickness corresponding to each character as formed in the casting and composing machine, and likewise registers the width of the space to be left between each word. It is quite difficult to make such a mechanical operation understood by mere words. M. Bachon, an engineer who has examined the machine, has nevertheless given a clear description of it, from which we borrow the following particulars:

"The operation of spacing," says he, "is performed by means of a measuring cylinder, the periphery of which is provided with grooves of a length proportional to the thickness of the letters to which they correspond. At the moment at which a letter-key is struck a tongue enters the groove corresponding to the letter, and the displacement of this tongue causes a train of measuring gears to advance to an extent proportional to the length of the groove and, consequently, to the width of the letter. On the other hand, a second cylinder, made of brass and provided with a seemingly infinite number of small apertures, is placed parallel with the space measuring cylinder. Each of the apertures of this, the justifying cylinder, corresponds to the result of one of the divisions that may be made between the number of the tenths that are to be distributed for justifying the line and the number of the spaces. This cylinder is actuated by the counting measuring gears in such a way that, at the moment at which the justifying key is struck, the aperture corresponding to the connection to be made places itself opposite a pin which enters it. It is the displacement of this pin that regulates the justification perforations."

The most interesting operation of the apparatus, which is represented in Fig. 1, is the deciphering of the perforated bands by the most delicate parts of the machine. The latter, so to speak, sees after the manner of the blind, according to the Hoüy system. The perforated ribbon (see Fig. 2) engages with the teeth of a small copper cylinder, and is held in close proximity to the tangent of the cylinder by two small rubber cylinders placed close to it on each side.

Above the copper cylinder, from which unwinds the perforated ribbon, are placed seven small magnetized rods parallel with the seven apertures formed horizontally in the width of the perforated paper. These are electric contacts, which operate like the magnets of a Morse apparatus.

When the ribbon unwinds these small rods, which bears lightly against the paper, come into contact with the copper of the cylinder every time one of them meets with an aperture. There is no contact without an aperture, the paper being an insulator.

These contact rods (or decipherers) are connected with an electric apparatus in which the first contact of the rods with the copper cylinder is repeated. This electric apparatus sets in motion, irregularly, a cog-wheel, the teeth of which, as a whole, form a combination corresponding to that of the perforations. One of these teeth, through the electric contact that actuates it, relaxes a spring which effects a pressure at the location of the matrix-carrier. The matrix then detaches itself from its carrier and places itself automatically before the stream of lead coming from the melting pot, and then immediately resumes its place in the carrier, and is replaced by another, and so on, as long as the composition casting lasts.

As soon as the letter is cast it is automatically ejected from the mold and passes between steel plates and cutters, which remove the seams from the four sides. Then the letter, after making a quarter of a revolution, assumes a vertical position and places itself alongside of its predecessors in a galley (Fig. 3), and so on.

In conclusion, it may be stated that the Meray-Rozar machine is capable of composing as many as 5,000 letters an hour, and that the regularity with which it operates leaves nothing to be desired.—For the above particulars and the illustrations we are indebted to La Nature.

TOBACCO TRADITIONS.

THE belief that tobacco smoke is a disinfectant has long been popularly held. As long ago as 1888 Dr. Paul Tassinari, of Pisa, subjected the germs of various deadly diseases (such as anthrax, cholera and typhus fever) to the action of dense clouds of imprisoned tobacco smoke during periods of 100 to 150 hours and he came to the conclusion that in most cases, and

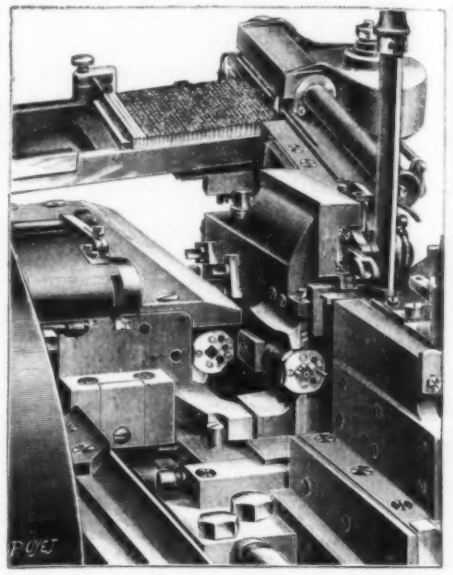


FIG. 3.—TYPE ARRANGED IN A GALLEY.

especially when large cigars had been employed as generators, the development of pathogenic bacteria was either partially or wholly arrested. But nobody retains smoke in his mouth for 100 hours at a time. An occasional pipe, indeed, scarcely counts in comparison with Dr. Tassinari's intense soaking process. Besides, under the conditions imposed by the Italian investigator, would not the smoke of coal or wood produce the same results as that of cigars?

It is recorded that during the Great Plague children were told to smoke in their schoolrooms. The idea was probably borrowed from the custom of the buriers of the dead on their way in charge of deadcarts to Holywell Mount. We read in "A Brief Abstract of the Virtues of the American Tobacco Plant," published in 1783, that at first these persons only used tobacco as a deodorizer, "little thinking that what they used for momentary relief would prove a constant preventive. When the plague was happily stayed, the virtues of tobacco began to be investigated; it was found that those persons who plentifully used it, either in smoking or snuffing, had most wonderfully escaped the dire contagion; for though they visited the chambers of the sick, attended the funerals of cartloads at a time, they unexpectedly avoided the infection." The writer even goes so far as to advance the theory that since Europe took to smoking, epidemics had greatly decreased and we find him stating the belief that dealers in tobacco were secure from plague infection. Yet he can assign no reason why tobacco should prove so valuable as a disinfectant except in so far as it fortifies the head against "exhalations."

Workmen in tobacco factories are often cited as being immune from cholera and other epidemics. It is interesting to trace this belief back. Abroad it probably received its first impetus in Toulouse, where

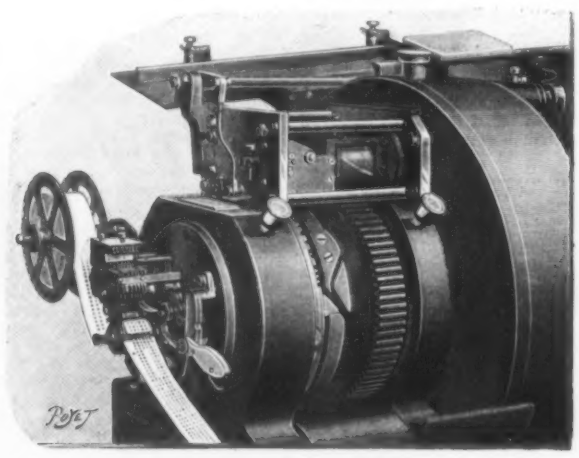


FIG. 2.—THE PERFORATED BAND.

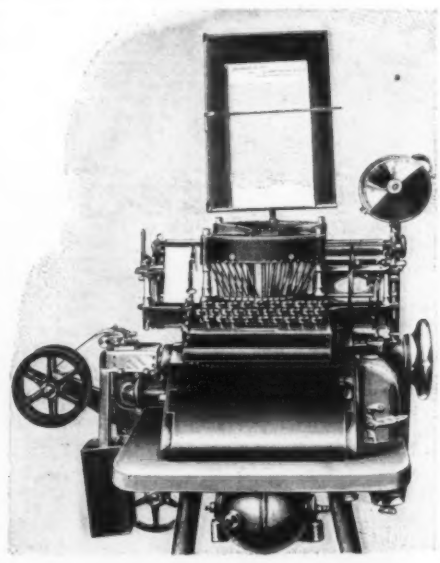


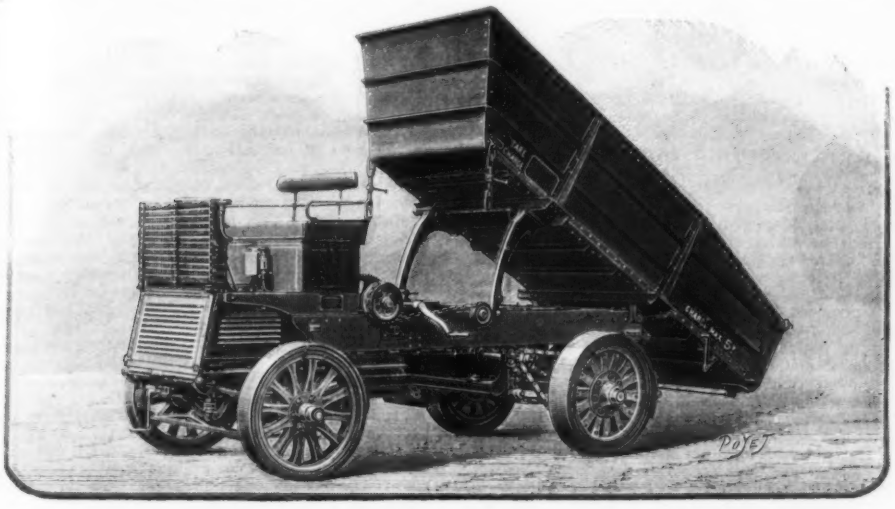
FIG. 4.—THE WRITING MACHINE.

shortly before the Revolution the workmen in the State tobacco factory are said to have remained immune during a deadly epidemic of suette (sweating sickness). The belief may, perhaps, be of the nature of folklore. The medical man attached to the Bordeaux State factory thought that this local industry was a veritable blessing to a damp and foggy town. "The piquant and ammoniacal emanations arising from the tobacco qualify the air and diminish its insalubrity. Before the establishment of this factory the poorer parts of Bordeaux had been ravaged by epidemics and contagions now unknown. The death-rate among the tobacco workmen is, he adds, very low, while very few cases of illness occur among them, although they are in general ill-lodged and clothed and even worse fed."

We have no new facts to add in evidence of the value of tobacco smoking in epidemic disease. As yet, at any rate, there is nothing authoritative to be said. —The Lancet.

THE INTERNATIONAL EXHIBITION OF ALCOHOL MOTORS.

THE second International Exhibition of Alcohol Motors, organized by the French Minister of Agriculture, and held in Machinery Hall, Paris, May 24 to June 1 last, was a great public success because of the good arrangement of the exhibition as a whole, and also because of the numerous interesting examples of alcohol motors there shown.



DUMPING TRUCK.

Without considering the lighting and heating apparatus exhibited in the Hall of Fêtes, we shall describe the portable, stationary and automobile motors only. The immense nave of Machinery Hall, between Labourdonnais Avenue and the Hall of Fêtes, was occupied in the center by a pleasingly decorated track for automobiles; on the left of this track were the stationary motors, and on the right the exhibit of automobiles, behind which could be seen the instruments used in the production of alcohol, from the plow to the still. An appropriately painted background showed very plainly the agricultural nature of the exposition.

The practical trials, which occupied the greater part of the month of May, had served to classify the various motors exhibited. We shall, therefore, make known only the principal results.

Stationary Motors.—The tests were made at the agricultural machinery experiment station on Jenner Street, under the supervision of M. Ringlemann, the director. They were made before a board of judges, the chairman of which was M. Michel Lévy, member of the Institute.

In the different classes of stationary motors, the constructors whose names appear most often at the head are among the following:

MM. Brouhot & Co. received an object of art for the artistic ensemble of the motors shown by them at the exhibition. Among these it will do to cite the 16 horse power motor, the extremely reduced consumption of which was only 233 grammes of 50 per cent carbureted alcohol per horse power hour.

The Swiss Société of Winterthur also showed very low consumption motors of 5, 19 and 34 horse power, as well as a motor group and Fafeur pump, which consumed per horse power (in water raised) 827 grammes of 50 per cent carbureted alcohol.

The Duplex Company exhibited in the different classes motors of 2, 8 and 10 horse power, as well as a portable motor and a motor pump.

The Société Aster showed a 6 horse power motor running; M. Prevost an 8 horse power motor, and, finally, MM. Desmarais and Morane a light two-cylinder 12 horse power motor with a speed of 1,100 revolutions per minute, analogous to those they construct for automobiles. Mention should also be made of the 6 horse power portable motor and the self-moving threshing machine of M. Eugene Beaupré, as well as L. Bardon's electric generating group, which consumed 140 grammes of pure alcohol per hectowatt hour.

Generally speaking the 1902 Exhibition has not revealed any very new arrangements for the utilization of alcohol, but this is evidently due to the short time since the former exhibition in November, 1901.

All the brake tests of motors made this year were completed by chemical analyses, the results of which were in perfect accord with the dynamometric tests. These analyses, which determined the composition of liquids employed as well as that of the exhaust gases, were made under the competent direction of MM. Sorel and Trillat, and a special chemical laboratory was installed for this purpose in the Jenner Street station. The results obtained in this laboratory by means of special apparatus and new methods will be published in a general report which will contain tables and diagrams of the experiments that will be found of great utility by constructors and also by buyers.

Automobiles.—Three automobile tests were held under the direction of M. Famechon, the distinguished commissary general.

1. Speed Test.—This test, permission for holding which on the highway was obtained from the Minister of the Interior, was held under the racing rules of the Automobile Club of France. The entire course of 673 miles was divided into two stages. The first stage, 255 miles in length, passed through Coulommiers, Châlons, Réthel, Saint Quentin and Arras; the second, with a length of 418 miles, included Saint-Pol, Saint-Omer, Boulogne-sur-Mer, Abbeville, Dieppe, Vernon, and ended at Saint-Germain. The race was held the 15th and 16th of last May.

The Panhard machine run by Maurice Farman won the alcohol automobile race. It covered the 673 miles in 15 hours 45 minutes, which was an average speed of 44.7 miles per hour, deducting the neutralized towns that were passed through. This same vehicle, in the first stage, maintained an average speed of 48.7 miles per hour. It was of the Paris-Berlin racing type, and weighed, empty, less than 1,000 kilogrammes (2,204 pounds). The third and fourth vehicles to finish were also of the Panhard-Levassor make. A Darracq racer weighing between 881 and 1,432 pounds and driven by Marcellin obtained the second place. Its mean speed was 41.5 miles per hour.

The Renault voiturette (551 to 881 pounds), driven by Grus, realized an average speed of 33.5 miles per hour.

Among the 21 vehicles that finished the race were 4 Serpollet steam carriages fired by an alcohol flame, a De Dion-Bouton tricycle, a Belgian Deschamps carriage and a Buquet-Werner motor bicycle.

2. Consumption Test—Touring.—This test was made on a 453-mile course, divided into three stages, as follows: Paris, Arras, 130 miles; Arras, Boulogne-sur-Mer, Abbeville, 161.5 miles; Abbeville, Dieppe, Vernon, Paris, 161.5 miles. The test was made on May 15, 16 and 17.

On account of very unfavorable atmospheric conditions but 24 vehicles completed the test, and, as the weather conditions were extremely bad, they were given a well-earned certificate of endurance and perfect operation.

The vehicle which showed the least consumption was the Chenard and Walcker, weighing 2,645 pounds in working order, with a 12 horse power motor. Its consumption was only .065 liter of 50 per cent carbureted alcohol per kilometric ton. That is a very low figure indeed, and it pays tribute to the motor and carbueter used, as well as to their inventors. Foremost among the other vehicles were the Bardon, the light Delahaye and De Dion-Bouton voiturettes, the Peugeot quadricycle and the Georges Richard, Gillet-Forest, Gladiator and other carriages.

This consumption test was completed by a series of dynamometric tests in the Jenner Street laboratory, in which all the 24 vehicles participated. The apparatus with which these tests were made and for the construction of which we are indebted to the liberality of M. Dupuy, late Minister of Agriculture and a distinguished automobilist, is based on the following principle:

As can be seen from the illustration, two belts about 20 inches wide are run parallel with each other over four cast iron rollers furnished with tighteners. The belts are properly spaced so that they will be the right distance apart to fit the tread of any ordinary automobile. Mounted on the same shaft with the rear rollers is a brake pulley for the purpose of creating supplementary resistance, while in front of the carriage is a large fan which sends a current of air against the radiating coils, giving the same cooling effect as when the vehicle is passing rapidly through the air.

The automobile is placed with one of its two driving wheels on each belt. A registering dynamometer that an ingenious arrangement makes it possible to raise or lower at will so that it can be used with frames of different heights above the ground has its fork attached to the rear of the vehicle.

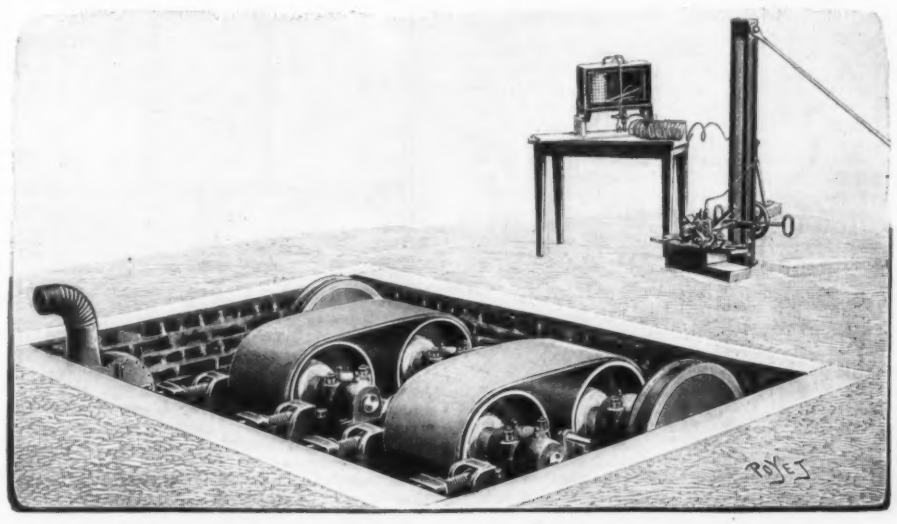
The motor is started and the wheels of the vehicle are set in motion the same as when it is traveling on the road. The belt is driven by the moving wheels, while the machine remains stationary. By means of a revolution indicator the speed of the carriage is determined, and this, multiplied by the effort of traction indicated by the dynamometer, furnishes immediately the power really obtained at the rim of the vehicle wheels. The results obtained, as much from the point of view of the power as of the consumption, have given interesting indications which will serve as the basis of a series of industrial essays that, effected with all the time desirable, will give very useful figures to the automobile industry.

3. Industrial Vehicles.—The consumption tests of this class of vehicles took place the 10th day of May over a 52-mile course from Beauvais to Paris. In the class of vehicles which carried less than 1,100 pounds' load the Société Georges Richard obtained first place with a small truck driven by a 5½ horse power motor. The truck carried a load of about 1,100 pounds, and its consumption per kilometer was .067 liter, which is extremely low.

In the class of vehicles carrying more than 1,100 pounds useful load the first place was taken by a Bardon truck, which hauled 2,615 pounds with an average consumption of .099 liter per ton kilometer. The truck of the Société Nancéeune obtained second place in this class, with a consumption of .134 liter per ton kilometer.

Mention should also be made among the vehicles that lead in this class of the same company's large dumping truck, as well as the Delahaye, De Diétrich and Gillet-Forest trucks.

Boats.—In spite of the fact that there were a large number of entries in this class but two boats took part in the trials. Both boats were built by the Tellier establishment and were equipped with Panhard-Levassor motors. One—the "Centaure"—was 26¼ feet long; the other—the "Lutece"—had a length of 49 feet and was furnished with two racing motors that together developed a nominal 60 horse power. This boat attained in the trials that were made with it, May 20 between Pecq and Conflaus, under the rules of the Helice Club, the remarkable speed of more than 17 miles an hour, with a consumption of 1.14 liters per kilometer.



APPARATUS FOR TESTING THE POWER OF AN AUTOMOBILE AT THE RIMS OF THE WHEELS.

All these tests taken together demonstrate once more that alcohol could replace advantageously the foreign gasoline in our explosive motors. No doubt each year of progress will see a greater use of it, and, consequently, a lowering of the price which will finally assure the safe use of this national combustible.

To Remove the Odor from Pasteboard.—The Papierzeitung gives two processes for removing the odor of pasteboard. 1. By using animal size on the surface. 2. By drawing the pasteboard through a 3 per cent solution of viscose in water. In both cases the pasteboard has to be calendered after drying.

THE RECENT "BELLEISLE" EXPERIMENT.

By FRED. T. JANE.*

THE "Belleisle" has been fired at again, the object of the experiment being in the main somewhat on Euclid's Q.E.D. lines, or proving that one and one make two. The objects were:

(1) To ascertain the effect of lyddite on a conning tower.

(2) To ascertain the effect of the same shell on torpedo nets.

In the first case the experiment was invalid owing to the "Belleisle's" conning tower being of a now unused pattern. That is to say, it is a circle entered from below. The modern tower is as shown herewith. In the "Belleisle" the gas had, therefore, only the top of the tower to act against. A caged rat placed inside survived—its reported death is a picturesque touch of description. Being below the rush of gas level, an air cushion might to a certain extent be expected, and direct concussion was not experienced. A man, on the other hand, would have been looking over the top of the armored circular wall, and his head in the full path of a blast far exceeding in force any hurricane that yet blew, and in temperature equalling, if not exceeding, white-hot iron. In a word, the equivalent of a blow from a white-hot steam hammer would be encountered. The result is one that pure theory is hardly likely to go astray over. Incidentally it has been "proved" that life may exist in a hole under these conditions, but any Boer who was at Paardeberg could have told that much.

The experiment was invalid to the extent that with a modern tower the rush of gas would follow the line of the arrow in the diagram shown, and so enter the tower directly. This is important in so far as the first effect of a hit on the tower must be to hurl to the deck everyone inside. The distance to be traveled by a head, from sight to cover, is so small that between the hit and the rush of gas a man might get out—or, rather, be flung out—of the direct path of concussion before the rush of blast came. With the modern tower, having side inlets, this chance will be taken from him probably, unless the angle to be followed tends to mitigate things, which is hardly likely. In any case, the tower fired at was not the tower we use. It may be instructive to note that it is the pattern the French employ, and all that we have yet done with the "Belleisle" the French have done years ago. If our Intelligence Department has soared at all beyond "scissors and paste" it is familiar with these things; and we are doing no more than "proving proofs." French ships have often three primary fighting positions, but for a long time there has been a feeling that the conning tower is, like the ram, a survival of obsolete ideas. It is an amateur idea at the best. It dates from the days when the shot that made a hole was the only projectile thought about, and that was never the only actual danger. Concussion killed men back in the days of the American Civil War, and to realize that the blast of a shell might cause concussion of the atmosphere was no gigantic step. The conning tower antedated these experiences, and has existed ever since without any very integral change in conception. Logic demands, and always has demanded, something in the open, and out of the "Belleisle" firing we may get it if the Admiralty have the courage of the progressive views they now seem to entertain.

Over the "Belleisle's" conning tower there was a bridge. This was brought down. It was made into a scrap heap, splinters and dust. The ideal tower cannot, therefore, be on a bridge. I may indicate what it may become if only progress can be given free rein.

Let us now proceed to examine the ideal conning tower, or, rather, let us say the conning tower that offers most chances of survival to the users of it. In diagram form "ideal" may apply to it, but an inspection of the second picture—which is based on what is known of the actual effect of gun fire on ships—will show that the absolutely ideal position cannot exist. Advantages can be relative only. An important point to remember, too, is the almost night darkness in which battles will be fought. Apart from the smoke from pierced uptakes, walls of blackness due to the dust that flies from coal bunkers at every hit may be looked for, and this may be an intolerable nuisance; though it is a point to which absolutely no attention has been given.

To return, however, to the diagram. The conning tower is essentially the ship's brain center. It contains:

(1) The steering wheel.

(2) Voice pipes, telegraphs and telephones to all parts of the ship.

(3) Indicators from the engine rooms, etc.

(4) The torpedo tube directors.

Now, the first question is: Are these things essential—need they all be in the conning tower? The answer to this is: In some form, yes. The wheel may transmit to a steersman below; but, since it must be under direct control of the captain, someone must be close to him to manipulate it. If he be beside the captain, he is to that extent in the way. His life is very valuable, for if he be killed the ship may drift for the few instants necessary to make her fall off, lose the fire of one or two guns, and perhaps the day. It must ever be remembered that in the naval battle of to-morrow, not merely the minute, but the second, will be a factor of urgent importance. Ergo, it is necessary that the steersman live, and that a re-place man be in a position of safety able to take his place instantly. As will be seen from the diagram—which embodies so far as possible all the latest ideas in this question—the quartermaster is below the captain, in a safe post, his replace-man below again. This steering post is in direct communication with the captain, who may either call down through the communication hole, or use the indicator. This is manual, so as to run the least risk of being put out or order. It may also communicate with a third wheel below water—an idea embodied in many ship designs for a long time.

The voice pipes will be a series of holes sunk in the armored floor, so that they cannot be shot or shaken away. They will be duplicated with electrical transmitters, also sunk in the floor.

The disposal of engine room indicators affords difficulty. Probably large ones, well in view, placed well away, will be best, but there is a field for invention here. I am not at all sure but that some system of throwing the revolutions onto a black screen by means of some automatic magic lantern arrangements might not be of value. Indicators, as they are, will be knocked over if the tower be hit, and since towers will be aimed at, and since it is the insane practice to place near them a mast—which serves to lay hostile guns by—towers seem likely to be the centers of many explosions. There are pretty theories of discriminating fire; in real battle it is the foremast that every gun will be laid on. If only 1 per cent hits are secured, bursts on or near the tower will be frequent. In the only naval action fought on scientific lines, the engagement between the Chilian "Blanco Encalada" and "Almirante Cochrane" and the Peruvian "Huascar," the "Huascar" was primarily done for by conning tower attack. Everything inside was smashed by the shock of outside hits even in those primitive days. In the "Belleisle" the smashing was still greater.

Torpedo directors might, I think, be elsewhere than

HORIZONTAL SECTION THROUGH MODERN CONNING TOWER.

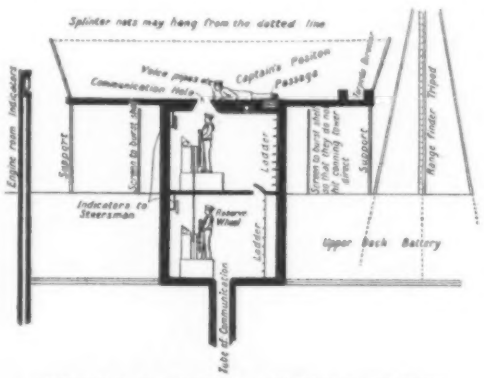
at the tower. They are not needed early in the action. They have hardly the ghost of a chance of survival as now placed. The feeling is that they should be in some spot less likely to come under fire. In all cases they need placing in duplicate, or, perhaps, in armored boxes, from which they can be extended when needed. In this form they might be on the conning platform.

Finally, no boats, guns, masts, funnels, cowls, rigging, or any other shell-bursters must be near the tower, but well away, boats in particular being below the splinter nets.

Two other accessories demand attention. Range-finders are placed on chart houses on the bridges. The "Belleisle" has indicated—were indication needed—of what use a range-finder so placed will be. Since it must be high up to get a clear view, it should, I think, be on a special tripod grating, clear of everything, the operator lying on it, and communicating ranges with a transmitter. Singing out the range is no use—it will not be heard. It is not heard properly even at target practice, the noise of which is a trifle to a battle noise.

The other accessory is signaling. In action there will be little, still it may be badly needed in the *final* stages. In the early stages it will be comparatively simple. Now we know from Yalu that all halyards are likely to go, and the first "Belleisle" experiment gave no promise of the survival of even light masts.

Two methods have been seriously suggested. One



SECTION OF IDEAL CONNING TOWER.

in a small captive balloon to which flags may be hoisted and cut away and sacrificed when done with, the other concerns colored shells for simple signals. This latter may be the best. In any case the admiral must have them under his control. So must the captain. Guns placed elsewhere can be discharged by buttons in the armored floor, and admiral and captain will probably be together. The idea of these colored shell sounds a little strange, but it is the only thing that seems practicable under the conditions of modern gun fire. The present "Belleisle" firing has shown that signalmen on a bridge will remain for a very little while, hence a substitute must be found for use under fire.

A tower such as I have indicated seems liable to only one main danger—Maxim fire. But Maxim range is not likely to be reached. A bulwark to protect against Maxims might be embodied, but it would all too probably grow to be a shell burster, and so bring us back to present evils. The captain must, I think, lie flat on his stomach, and chance such target as he offers thus. He will be safer so than inside even three feet of armor. It is not bits of projectiles so much as torrents of atmospheric hurricanes that he has to fear, and these he will surely avoid best by being in the open where shells will not burst near him. In diagram form that is his only danger, but the study of a pictorial realization of the same thing shows that "bits of ship" are by no means negligible factors. Still, splinter nettings may do much, while a further gain will be that, though not obstructing the view, they will prevent the otherwise probable contingency of the captain being blown off his platform by the shock of his own guns.

I put forward these remarks in the hopes of drawing careful attention to this vital question. I do not claim it as a best possible. But I do claim that it faithfully illustrates a trend of naval thought, needing a consideration that it does not receive. The "Belleisle" has proved clearly enough that the conning tower, as anticipated, is a totally useless contrivance in its present form. It is absolutely essential that the captain exist, the hard question is—How?

Another portion of the experiment was devoted to torpedo net defence and its behavior under fire. Its behavior again was as anticipated—it was blown all to pieces. The shells tore it apart, flung and drove it all over the ship, and generally totally destroyed it. The blast burned up everything that could be burned. This is quite new. Lyddite has a solid reputation as being a non-burning explosive, and the only explanation I can offer is that some new form of it, or some other new high explosive, was used. Whatever it was, the ship's side was a mass of flame, and when it passed every rope had gone with it, and many smaller wire ropes were melted. At one stroke, therefore, torpedo-defence nets are put out of court, for if ever they are wanted it will be after an action. This means that some protection must be evolved, or else the old plan of carrying nets inboard resorted to, unless, as is by no means impossible, we resort to fighting with them down. This will entail a heavy loss of speed and all tactical speed advantage, but speed as a purely tactical asset has little value save for peace maneuvers in which admirals make cheap reputations. So many things will reduce it in war that a loss right away may signify little. Torpedo craft, submarine or otherwise, will be such a terrible danger to ships in the heat of battle and at the end of it that almost any sacrifice may be needed to guard against them.

Thus, then, the main conclusions and lessons to be drawn from the last "Belleisle" experiments. There are other minor lessons that I do not think it well to discuss. The main issues are too obvious for any secrecy to be worth maintaining, for anyone could have foretold most of them. Still between a forecast and a realization there is always a difference, and "prove all things" is by no means a bad motto for naval warfare.

The main regret is that the effect on personnel was not better gaged. A rat is not a man, nor can a rat record experiences. It is these that we so urgently need. To try and obtain them with dummies is vain. A dummy very poorly indicates the atmospheric effect; and though the dummy captain of the "Belleisle" was "shot through the heart" by a piece of stray splinter, this was pure accident and chance. Human observers are needed, and I am quite sure volunteer lieutenants could be secured by promise of promotion, say, to commander at once and captain at the first possible time. There is, did people only know it, a deal by way of precedent, only hitherto it has been without prizes. Thus in the Chino-Japanese war a British torpedo lieutenant served "for experience" in a Japanese boat attacking Wei-hai-Wei—of course unofficially. Officially, artillery officers were put in more or less dangerous posts of observation at the Steepholm experiments, and much valuable—and unsuspected—information acquired. More recently something of the sort happened in the Channel fleet, only then those experimented on were not informed of the scope of the experiment. Then, too, at Portsmouth, when a boom was rushed the Admiralty insured the lives of all concerned, which marked the risk. Knowledge cannot be acquired without it. A hundred years or so ago the condemned criminal would have been used with freedom as the prize of survival; to-day, apart from sentiment, the observations of such a one would be no good. There are plenty of gunnery officers able to give the necessary ability, and there is no reason why they should be killed to a certainty; or, if they were, then we should learn that the big ship is obsolete. We have everything to learn in this respect, and even the effect in quite some other part of the ship to that hit would be learned with advantage. The wildest theories are afloat concerning the deadly effect of lyddite both as an asphyxiator and as a cause of concussion and heat. The heat can be gaged by metal or thermometers, the concussion effect approximated by mechanism, but vaguely only. The asphyxiation effect can equally vaguely be guessed at from the effect on animals, but this is not a sure guide, and in any case, as I have said above, animals cannot relate their experiences, nor would medical examination go for much. The effect on brain and nerves cannot be thus represented at all. Yet there are scientific men who assert that, in the confined space of a ship a single 6-inch lyddite shell may incapacitate nearly everyone. Will it, or will it not? It is of urgent importance that we should know; and the "Belleisle" has given so far a very undecided answer, even when surmise based on vague indications is accepted as proof. Before the old hulk is done with we shall have to solve these problems, and the human observer will have to be on board her. Probably he would have been already but for the sentimental outcry that any fatal termination might have led to. The only way to meet this is to prepare the public mind for it; for it is useless to pretend that the necessary experience could be gained without grave danger to the observer. But without this observation the experiments must remain incomplete. There is too much tendency to ignore the human element in these sort of trials, for the cardinal question must ever be not the effect on *materiel*, but whether the personnel can survive. If so, the damage to the ship matters little; while the crew exist she can still fight. If the crew be killed or stricken with panic or physical incapacity, then most of our naval architecture is vain. It has often been prophesied that the doom of the big ship will come over the invention of a projectile, one single hit from which will annihilate. The future in these matters may be left to itself. The problem is: How far is that stage already reached? Probably it is not reached. But we do not know. And because it gives no answer, because it tells us all that we could have guessed, but nothing of what we cannot guess, the "Belleisle" experiment remains incomplete, and to that extent unsatisfactory.

* The Engineer.

THE PHYSIOLOGICAL EFFECTS OF DIMINISHED AIR PRESSURE.

By E. G. DEXTER.

RECENT discussions upon the general subject of the influence of the altitude upon the rapidity of pulse and respiration have served to remind me that I had certain data bearing upon the subject which had never been worked over, and have led me to put them in shape for a brief statement. A residence of seven years in Colorado, at altitudes approximating a mile, with frequent visits of considerable length to the higher altitudes, among them several to the summit of Pike's Peak, have made possible a considerable number of general observations. These, however, I do not intend to discuss at this time, as they differ but slightly from those stated in the letters referred to. The facts which I have to present are based upon the following questionaire:

Name..... .....Age.....

Years lived in this altitude.....

Where lived previously.....

Any tendency to lung disease in family? ..... If so, what evidence? .....

PULSE.

(At not less than 3 hour intervals, and after no violent exercise.)

	First Observation.	Second Observation.	Third Observation.	Fourth Observation.
Time of Day.....				
No. per Minute. ..				

BREATHING.

(Under the same conditions as for the pulse.)

	First Observation.	Second Observation.	Third Observation.	Fourth Observation.
Time of Day..				
No. per Minute.....				

Spirometer measurement.....

Weight.....

Height.....

This questionaire was filled out in full for 206 persons under the following conditions:

City.	Altitude.	Person.	Sex.	No.
Greeley, Col.	4,600	Student in State Normal School.	Male.	46
" "	"	" "	Female.	106
Denver, Col.	5,200	Pupil in High School.	Male.	17
" "	"	" "	Female.	20
Leadville, Col.	10,500	" "	Male.	6
" "	"	" "	Female.	11
			Total ...	206

I fully recognize the fact that the number of data is insufficient to form the basis of any valid conclusions, but present them for what they are worth. The pulse and respiration were recorded by the parent or by the subject, and the results open to the usual criticism of observations made under those conditions. Records of height, weight, and vital capacity were made by me, the latter by means of an ordinary wet spirometer. The exact figures for pulse and respiration are shown in the following table:

GREELEY.

Males.

Weight Between.	Average Age.	Number.	Pulse.	Respiration.
76-115	17.	7	76.	23.
116-125	18.	10	77.2	20.9
126-130	17.	2	74.5	23.
131-135	16.	1	80.	31.
136-140	20.	4	68.	17.2
141-145	24.	2	73.5	18.5
146-150	24.4	5	68.8	18.4
151-155	21.6	3	89.6	17.
156-160	23.	3	67.8	19.8
161-170	24.	7	65.	19.7
171- +	19.5	2	71.	19.
		Total 46	Aver. 72.8	Aver. 20.1

Females.

76-115	17.8	41	80.6	20.8
116-125	19.1	22	77.6	21.6
126-130	20.4	16	80.4	19.4
131-135	20.2	10	76.7	20.
136-140	19.	5	75.4	21.6
141-145	21.3	6	73.9	18.6
146-150	21.3	3	72.	19.
151-155	18.	1	73.	15.
156-160	18.	2	84.	22.5
		Total 106	Aver. 78.7	Aver. 20.5

DENVER.

Males.

76-115	15.3	3	79.3	19.3
116-125	18.8	5	74.	19.2
126-130	18.	2	77.	21.
131-140	18.4	5	79.2	17.6
141-150	18.6	1	71.	18.
151-160	16.	1	79.	20.
		Total 17	Aver. 76.9	Aver. 18.7

Females.

76-115	15.	10	82.1	23.
116-125	18.	4	81.	19.
126-130	17.	2	81.	24.5
131-140	18.4	4	81.7	22.2
		Total 20	Aver. 81.4	Aver. 22.2

LEADVILLE.

Males.

76-115	13	5	76.	26.
116-125	14	1	87.	18.
		Total 6	Aver. 77.9	Aver. 24.6

Females.

76-115	12.5	10	79.	21.5
116-125	17.	1	76.	22.
		Total 11	Aver. 78.7	Aver. 21.6

As might be expected from averages based upon so few data, there are marked differences shown by the groups considered, and curves based upon them would have but little value. The general averages are, however, worth something. For purposes of comparison, the data for Greeley and Denver may all be considered as being from an altitude of approximately one mile, while those from Leadville represent approximately two miles. Such a comparison is shown in the following table:

PULSE.

	1 Mile.	2 Miles.		1 Mile.	2 Miles.
Males	73.9	77.9	Females...	78.7	78.7

RESPIRATION.

Males.....	19.7	21.6	Females...	20.9	21.6

It is noticeable that except for the pulse of females, where we have the same figures for both altitudes, there is an increase in rapidity as we ascend. As a basis of comparison with the sea level, I am taking Milne Edwards' figures for pulse and Quêtelet's for respiration. They are:

Pulse.			Respiration.	
Years.	M.	F.	Years.	
14-21	76	83	15-20	20
21-28	73	80	20-25	18
28-35	70	78	25-30	16

The comparison gives us no very startling result. In rapidity of pulse we have no excess for the altitudes. For respiration we do seem to have, though when we consider that the average age of the persons studied at the two miles level was but 15 years, it cannot be very great.

The results of the study of vital capacity I have shown by means of curves, plotted from mediums, rather than averages of groups. For comparison with sea level (approximately) the curves have been adapted from those given in the "Report of Committee on Child Study and Pedagogic Investigation," No. 2, of the Chicago School Board, and also one for adults based upon Rich's Physiology. The Chicago figures do not vary materially from Kotelmann's and are probably valid.

The curves (not shown) indicate no increase in vital capacity for increase in altitude; in fact, the reverse seems to be true. Both for males and females, with no important exceptions, the curves for Chicago are above those for an altitude of one mile, while the latter are above those for two miles, although these should have but little weight in arriving at any conclusion, because of the fewness of data upon which they are based.

It is possible that the differences between the Chicago measurements and my own are due in part to a difference in the method of making the test. The Chicago report says with regard to it: "Repeated trials were allowed the child until he fell short of his previous effort, and the best mark attained was recorded." I simply allowed one preliminary trial and recorded the second attempt. I am inclined to think, however, that my curves indicate pretty nearly the existing conditions. My own vital capacity fell off about 25 cubic inches in the first six months of residence at Colorado Springs (altitude 6,000). It is certain that processes of oxidation in the lungs at high altitudes are not kept at the normal by an increase in lung capacity proportional to the decrease in the density of the atmosphere. At an altitude of two miles the latter is but 2-3 that at the sea level, which would require a compensating lung capacity of 3-2. This is certainly not the case. At Leadville there seems to be the usual proportion of narrow-chested individuals and seemingly no excess of the big-chested type. It seems to me probable that the compensating changes, besides possible ones in the composition of the blood, are:

1. An increase in the rapidity of respiration.
2. An increase in blood pressure.
3. A slight increase in the rapidity of pulse.

The second is, I believe, a much more important factor than the third, although I know of no systematic effort to demonstrate it. I have, however, noted these facts for high altitudes which seem corroborative:

1. One much readily hears the blood pulsating through the smaller vessels of the ear.
2. When the legs are crossed and one foot is left suspended over the other knee, the movement given the foot by the pulse seems of greater amplitude.
3. In my own case the sphygmographic curves from the carotid artery seemed to have greater amplitude. Of course the question of instrument and adjustment comes in here, but I am convinced that the difference exists.

University of Illinois.

IMPROVEMENT IN THE PREPARATION OF MATCH PASTES WITH SESQUISULPHIDES.

By M. BLANC.

To describe this improvement, we can do no better than to give the example below furnished by the patentee for conducting the operation and obtaining a good result.

Take of sesquisulphide of phosphorus, 6.5 parts; potassium chlorate, 22; ocher, 14; zinc oxide, 5; ground glass, 10; glue, 14; and water, from 29 to 32 parts.

The glue is dissolved in its weight of water. A very thorough mixture of the other substances, with the exception of the sesquisulphide, is made by grinding and sifting, and the rest of the water is added.

The sesquisulphide of phosphorus, with a small quantity of carbon sulphide (90 to 100 c.c per kilo of sesquisulphide), is introduced into a malaxator and heated slightly to facilitate a solution, and the solution of glue is added, which should be at a temperature lower than 40 deg. C. It is then heated energetically. The emulsion can be prepared in ten minutes. The rest of the mixture is added and the whole made homogeneous.

For use, the paste is reheated at a temperature between 30 deg. and 40 deg. C. The dipping takes place on an iron plate slightly warmed (30 deg. to 40 deg. C.). This temperature should never be exceeded, because the phosphorus sesquioxide in this extreme state of division is very rapidly decomposed. The paste keeps better when not overheated.—Translated from the Revue des Produits Chimiques.

THE COLOR OF WATER.

RECENT investigations of natural color in water show that it is due to two distinct causes, vegetable stain and suspended matter. When the latter is present in appreciable quantity, it causes turbidity and is not a real pigment. The true color or vegetable stain is greenish-yellow to reddish brown, and is due to decayed plant growth; the suspended matter is generally mineral and often contains iron. The color acquired by water at the bottom of a deep pond is largely due to this cause.

Experts have adopted a method of stating the depth of color in water by comparison with a mixture of platinum and cobalt, the color produced by one part of platinum to one million parts of water being taken as the unit.

Thus it has been shown that the color of surface water depends both on the character of the neighboring vegetation and on the time that the water remains in contact with it. Water near steep rocks, where there are few trees, will generally be below twenty units in color; steep wooded or cultivated slopes give twenty to fifty units; similar, but gentler slopes, from five to one hundred; and swampy areas, one hundred to five hundred, or even higher. Highly colored waters are more common in the Northern States than in the South. Colored water is gradually bleached by sunlight, the action taking place chiefly within one foot of the surface. The study of color in water is of commercial importance, because most people object to drinking brownish water. Hence, in a town water supply the color must either be removed or its formation must be prevented. The latter is often the most economical thing to do, and it may be accomplished by intercepting the water from the uplands and leading it into the streams without letting it pass through the swamps.

Filtering through sand will not remove the color from water, and even clay will take it out but partially. Generally, the water must be altered chemically, as by mixture with sulphate of aluminium, which coagulates the coloring matter. The color may also be removed by oxidation, as with permanganate of potash, or by ozone; but this method is not much in use at present. The question is largely one of æsthetics, as natural coloring matter in water is rarely harmful.—Arthur E. Bostwick, in Success.

FOUNDRY SCHOOL NEEDED.

THE necessity for a foundry trade school, discussed at the convention of the American Foundrymen's Association in Buffalo last summer, was ably considered in a paper read by Thomas D. West, of Sharpsville, before the Pittsburg Foundrymen's Association this week. In outlining the plan, Mr. West said:

The are of founding is suffering keenly from the antipathy of boys to learning the trade, and the degeneration of skill due largely to the same forces that are effective in other callings. To assist in remedying these evils a foundry trade school has been proposed. It is intended that this trade school shall accept, among others, boys having graduated from the public, grammar or high school, who would bind themselves for three years and a half as apprentices to learn the foundry trade in all its branches. The policy of keeping a student on one job after he had learned to do it well, so as to make the most money out of his labor, as in general practice, would not be allowed, as such a policy would be detrimental to the aims and interests of the school. Such a trade school should make much better mechanics than is possible under present conditions, and even with the best opportunities in outside shops would give our country better workmen in three and a half years than a six or seven years' apprenticeship under present conditions.

THE LARGEST HYDRO-ELECTRICAL PLANT IN EUROPE.

THE largest electrical plant in the world where water is used as a primary force is in Lombardy, and owned by Italy some time since. The plant is the more interesting as its origin is due to German industry. It is the water power of the Tessin, whose mighty current, by means of dynamo machines, has been placed at the disposal of the industrious people of Lombardy, so active both intellectually and industrially. For thousands of years these mighty natural forces lay idle; now the wild stream is chained. Its mechanical efficiencies are transformed through dynamo machines and it now furnishes the seamstress with power for her sewing machine, to whom it also gives light in the evening, and it turns the locksmith's lathe, and planes heavy pieces of iron, and rivets and gilds. Of course, the mandrakes that once played a prominent part in the comfort of the people in Cologne on the Rhine have not yet appeared to relieve men from work; yet the little sprites that dwelled on the Tessin so long are at last summoned to the working table through many miles and given the heavier part of the work while man plans and presides over it.

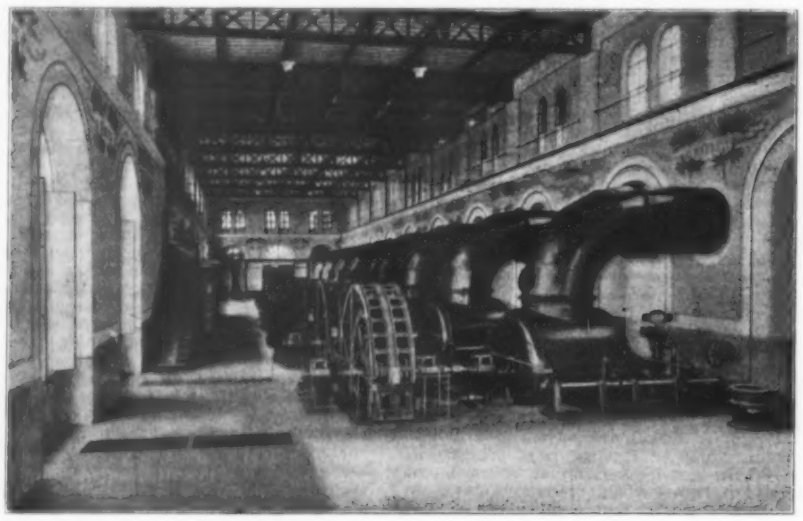


FIG. 1.—INTERIOR OF PLANT.

The application for the license to fetter the mighty power of these little sprites onto the laborers' tables was filed in 1897 by the Continental Company for Electrical Enterprises in Nürnberg. Thus the idea of the whole plan originates from Germany. As soon as the license was obtained a special company was formed in Lombardy, with a capital of 10,000,000 lire, to establish powerful waterwheels and a central plant in Vizzola near Milan. The interior of the latter is illustrated in Fig. 1. The turbines were manufactured partly in Germany, partly in Italy. They yield 20,000 horse power, and are divided in ten sets of machines, each of which yields 2,000 horse power. Besides the turbines at least two sets of induction engines of 200 horse power each had to be added in order to exhaust them. Lombardy so relished the thing as to acquire soon another water power of 7,000 horse power. This is very comprehensible, for the power yielded is so cheap that by actively operating the plant Lombardy must reach a state of renewed and increased prosperity. As is known, German canals are to be connected some day with electrical central stations which shall deliver power all over at cheap rates and change the conditions in the development of municipal and rural industries from top to bottom. In the case of Lombardy it can be seen that these ideas which are indorsed by one of our best scientists, Prof. Slaby, of the Academy of Charlottenburg, and to which he seeks to enroll adherents are far from being empty dreams.

In order to bring the water of the Tessin to the turbines a canal 6,900 meters long had to be constructed, having a height of water of 0.15 : 1,000, and a sectional area of 60 square meters and of 43 square meters at high and at middle water level, respectively. The rate of velocity of the water is 1.37 cubic meters per second. At high water level the canal wields 75 cubic meters of water per second, which are thrown upon the turbines from a height of water of 24 meters. At low water level the canal only yields 63 cubic meters of water per second, and in this case in order to obtain the same action on the wheels the water height is increased by 4 meters, so that it is 28 meters.

A little before the entrance in the central plant the canal passes over a depression in the ground, which required the construction of a bridge. This canal bridge (see Fig. 2) is 250 meters long and an extremely interesting structure. The water is led down broad steps. Above the central plant the canal empties into a wide reservoir (see Figs. 4 and 5), whence thirteen large iron pipes lead the water to the turbines. For the construction of the canal 1,200,000 cubic meters of earth and 130,000 cubic meters of walling were removed. Nevertheless the entire works, including the electrical machinery, which were supplied by Messrs. Schuckert & Co. in Nürnberg, were completed within two years.

The current generated in the electrical central station has a tension of 10,000 volts. The length of the primary net is 120 kilometers, that of the secondary net is 20 kilometers with a current of 3,600 volts. The annexed figures can only strengthen te impression one derives from the description of the plant. It is plain to see it is a piece of construction as ingeniously planned as it is boldly executed. It claimed the attention of the Italian royal pair, who just paid a visit to it. In order to inspect it one takes the train from Milan to Lago Maggiore along the Tessin as far as the station of Gallarate, from there are reached by coach Vizzola and the mighty works of the central station of the reservoir and the wheels. Here also is viewed the aforesaid bridge, as illustrated in its characteristic features in Fig. 2. The height of interest is where the plant turns off the waters of the Tessin (see Figs. 3 and 4) in order to place its wild sprites in the service of labor.

Busto Arsizio, Legnano, Gallarate and Saronno, which are 10 kilometers and upward distant from Vizzola, are the chief places fed by the power house. The lock at Somma Lombarda, which turns off the Tessin, is 7 kilometers from Vizzola. By means of a canal of equal length it delivers from 63 to 75 cubic meters of water per second to the collective reservoir at Vizzola, which returns it to the Tessin with a height of fall of 28 meters. This power, through a net of wires of a total length of 150 kilometers, is supplied to 60 factories and 20 communities, all of which derive their light from the Tessin.

It will be interesting to compare the largest European plants with that of Vizzola: 1. Vizzola, 23,000 horse power; height of fall, 24 to 28 meters. 2. Jonage on the Rhone, 18,000 horse power; height of fall, 10 to 12 meters. 3. Paderno on the Adda (power house for Milan), 15,000 horse power; height of fall, 24 to 28 meters. 4. Rheinfelden on the Rhine, 15,000 horse power; height of fall 3 to 5 meters. 5. Chevres on the Rhone, 14,000 horse power; height of fall, 4.50 to 8.50 meters. 6. Morbegno on the Adda, 7,500 horse power; height of fall, 30 meters. 7. Bozen-Meran, 6,000 horse power; height of fall, 70 meters.

The new plant of Vizzola also feeds the electric road, Milan-Barese. To this end the central station of Tornavento sends an alternating current of 13,500 volts to Gallarate, 11 kilometers distant, and to Parabiago, 19 kilometers away. Transformers carry this strong current to 420 volts, transform it to a direct current of 650 volts and so carry it to the cars, whose four motors yield from 300 to 640 horse power and can each transport 73 persons.

The plant of Vizzola has cost about 9,000,000 lire. The industrial districts it supplies, mainly cotton manufacturers, figure that through the Tessin they save 2,500,000 lire a year which previously had to be paid out for English coal.—For our illustrations and the accompanying description we are indebted to Illustrirte Zeitung.

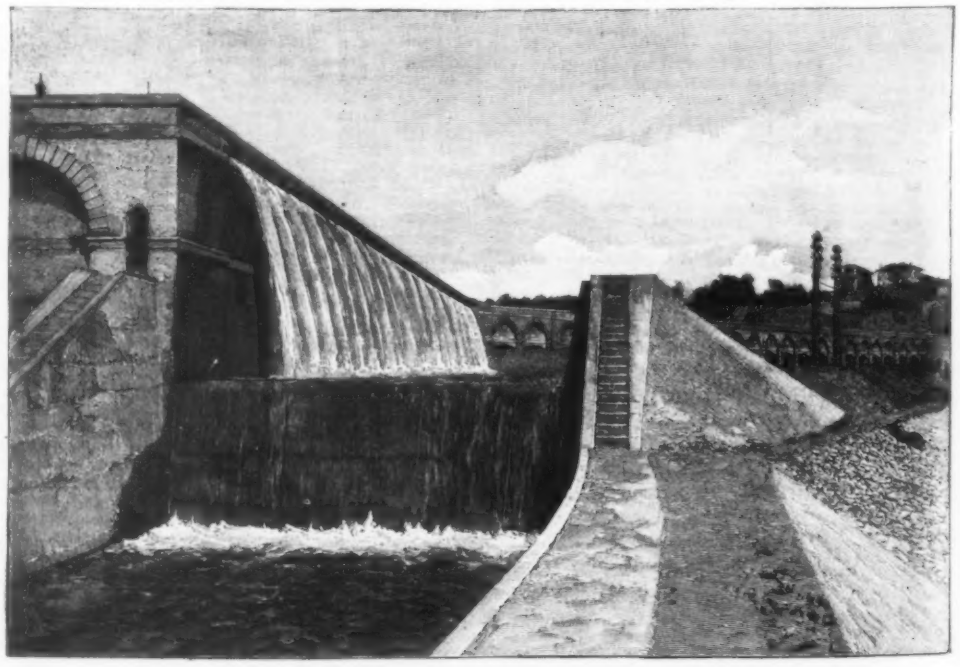


FIG 2.—STEP-CANAL AND CANAL BRIDGE.

CONTEMPORARY ELECTRICAL SCIENCE.

SENSITIVENESS OF THE COHERER.—E. R. Wolcott has attempted to determine quantitatively the effect of electromagnetic radiation upon coherers composed of metals of various critical potentials, including aluminium, tin, iron, zinc, lead, nickel, copper and silver. He finds that the "electrolytic" theory of Guthe and Trowbridge corresponds most closely with the facts. According to this theory the potential gradient across the coherer causes an attraction of the electrodes to within molecular distances, thus making a continuous bridge. Of all the metals tried, aluminium is the most regular in response. It has been found, however, by Marconi and others, that nickel gives the best results at long distances. This is probably due to the fact that of all metals tried the surface coating of nickel shows the lowest critical potential, that is, it responds to the least energy; but when the intensity of the radiation is sufficient to overcome the greater critical potential of aluminium, the latter gives better results than nickel, for the regularity of response has been shown to depend upon the metal itself. Accordingly, it appears that the best results would be obtained by using the metal which shows the greatest regularity of response, coated with a medium which gives the lowest critical potential.—E. R. Wolcott, Bull, Wisconsin University, No. 51, 1901.

THERMO-ELECTRIC HYSTERESIS.—Bachmetieff has described what appeared to him to be a well-defined case of thermo-electric hysteresis. He observed that the thermo-electric force between two metals differs accordingly as to whether the temperature of the hot junction is attained by heating or by cooling from a higher temperature. The theoretical importance of such an hysteresis has led E. Pinczower to repeat the experiment with apparatus of greater accuracy and sensitiveness than Bachmetieff's. The result was negative. A great variety of metallic combinations were chosen, and a wide range of temperatures. The E. M. F. was measured by a null method. The standard "hot" temperature was that of boiling water, and this was reached either by exposure to steam or by cooling from the temperature of a Bunsen flame or an oil bath. The E. M. F. was always found to be that corresponding to the interval of temperature, no matter how the temperatures were reached.—E. Pinczower, Mitt. Phys. Gesell. Zürich, No. 1, 1901.

REPULSIVE FORCES IN THE UNIVERSE.—H. Deslandres calls attention to the astronomical importance of the Maxwell-Bartoli pressure of radiation in the evolution of celestial bodies. Arrhenius' theory of the aurora and of comets may be reduced to the single hypothesis of the projection of cathode rays from the sun. All celestrial bodies show a continuity of transition from one type to another. Most nebulæ show evidences of a spiral structure, with two spirals diametrically opposed. Any great protuberance of the sun is accompanied by a similar proturberance at its antipodes. The only difference between the sun and the nebula is that in the latter the repulsive force is strong, while in the solar type the attractive force is the strongest. There may be a periodic oscillation from one type to another. The author points out that a sudden increase in the light of a comet should take place whenever it is exposed to the rays from a large protuberance or facula.—H. Deslandres, Comptes Rendus, May 20, 1902.

EFFECT OF INDUCTANCE UPON SPARK DISCHARGES.—B. Eginitis has studied the heat effects on the poles of a spark-gap as affected by a variation of the inductance of the circuit. He uses Tesla coils without a core, and poles of thin wire. At first the brightness of the aureole varies inversely as the heating effect for all metals examined. At high inductances both the temperature and brightness increase with increasing inductance—at least, in iron and nickel. The author

* Compiled by E. E. Fournier d'Albe in The Electrician.

made a closer study of the effects by determining the temperatures of the poles with the aid of a thermo-electric couple. The metals examined included iron, nickel, aluminium, copper and silver. The heating effect is of a very complex nature. It first increases rapidly with increasing inductance, and then breaks into a succession of maxima and minima. A rough generalization arrived at is that the metals whose heating is very great are also those whose spectra are enriched by an increase of inductance, as in the case of the highly magnetic metals. The presence of metallic vapor is not a primary factor in the heating effect, as is shown by the fact that at small inductances the brightness of the spectrum decreases with increasing inductances, whereas the heating increases very rapidly.—B. Eginitis, Comptes Rendus, May 5, 1902.

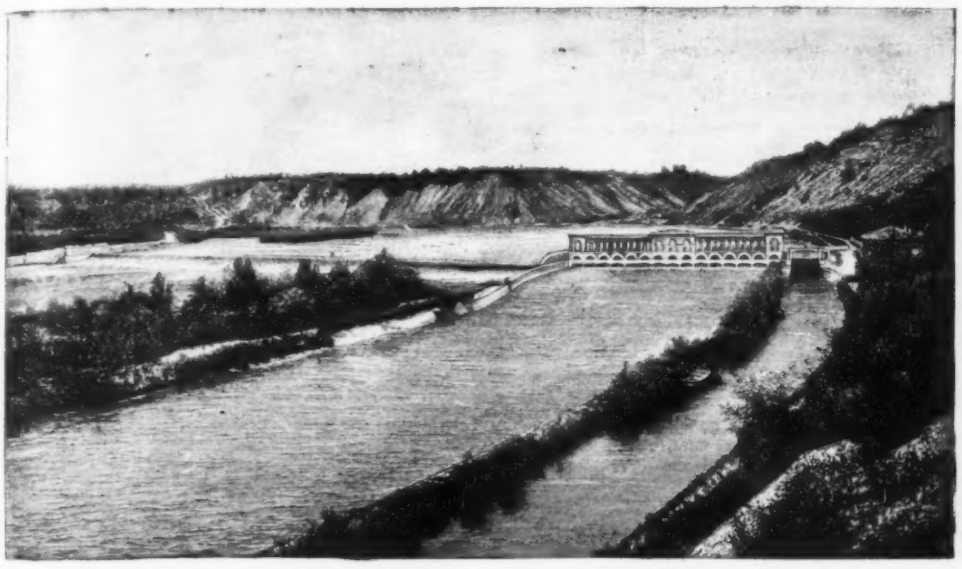


FIG. 4.—TURNING OFF OF THE TESSIN.

RESISTANCE OF A MAGNETIC FIELD.—H. Pellat adduces some further evidence in favor of his contention that there is a kind of friction across the tubes of magnetic force which makes the electric corpuscles tend to run along them rather than across them (see The Electrician, p. 1,005, 1902). A cylindrical tube 1 meter long and 17 millimeters in diameter, and showing a good stratified discharge, is placed between the cylindrical pole-pieces of an electromagnet so that its middle, say, is embedded in a strong magnetic field at right angles to the axis of the tube. As long as the field has not more than some 425 units, the anode stream is deviated in the well-known manner, forming a thread along the wall of the tube, and getting thinner and brighter with an increasing field. But if the field is increased to about 7,000 units, the anode light fills the whole tube nearly uniformly, without stratifications, and the resistance of the tube increases some twenty-four times. If now a second and thinner tube is fused into the first, so as to form a branch circuit which does not pass through the strong magnetic field, the whole discharge passes through this branch tube, just as if its resistance were enormously less than that of the main tube. When the lines of force run along the tube instead of across it, the anode stream traces out the lines of force.—H. Pellat, Comptes Rendus, May 5, 1902.

A SELENIUM TELAUTOGRAPH.—A new instrument for the reproduction of images at a distance has been devised and tested by A. Korn. It is based upon the sensitiveness of vacuum discharges at an exhaustion of 0.2 to 2 millimeters to slight changes in the resistance of the circuit, and the extraordinary photo-chemical activity of the rays proceeding from the discharge tube. The picture to be transmitted is divided up into small squares, each of which is projected in turn upon a selenium cell. At the receiver end a sensitive plate is made to move past an aperture transmitting the X-rays at a rate corresponding to the motion of the original picture at the sending end. The variations in the current produce a variation in the size of a spark-gap, which in turn produces a corresponding variation in the actinic intensity of the vacuum tube. A period of two seconds suffices to give a good impression of each square. The manner in which the spark-gap is shortened is ingenious. An astatic galvanometer carries, in addition to the two needles, a small brass needle acting as one of the electrodes of a spark-gap. The greater the deflection of the galvanometer, owing to the illumination and consequent lowering of the resistance of the selenium cell, the more does the brass needle approach a fixed needle representing the other electrode. One of the electrodes of the vacuum tube is attached to the fixed needle, while the other electrode is put to earth, and the movable needle is connected with one of the poles of the secondary coil of a Tesla apparatus. The second pole of the Tesla coil is connected with a large capacity. The author has worked successfully with pictures consisting of 400 squares. He proposes to reduce their size to 1 millimeter, and the exposure to a tenth of a second.—A. Korn, Electrotechn. Zeitschr., May 22, 1902.

IONS IN THE ATMOSPHERE.—H. Ebert describes some simple and instructive experiments to demonstrate the ionic charge of the atmosphere. A plate of tinned iron, 2 square meters in area, was supported 4 meters above the earth's surface on insulating pillars, planted on the top of a slope 70 meters high overlooking the river Isar. On a fine-weather day the plate was first connected to earth, and, of course, acquired a negative charge. It was then disconnected, and left to itself for some time, so as to acquire the potential of the surrounding air. Finally, it was earthed through a galvanometer, and showed a current proceeding from the plate to the earth. The exposure necessary for acquiring the potential was greatly shortened by covering the plate with sods of grass, the time then required being usually about five minutes. The charges acquired varied within wide limits with the weather, being largest in fine and smallest in foggy weather. This shows that the connection of negative ions from the atmosphere to the earth varies in accordance with their mobility in the atmosphere. A rough estimate of the quantity of electricity thus conveyed on a fine day gives about 300,000 electrostatic units per square kilometer per minute. This gives a mean current density of $1.7 + 10^{-16}$ amperes per square centimeter, which corresponds well to the value of $0.42 + 10^{-16}$ amperes per square centimeter found by Rutherford and Allen in the laboratory.—H. Ebert, Physikal Zeitschr., May 1, 1902.

RESEARCHES CONCERNING LIGHTNING.

THE Royal Institute of British Architects and the Surveyors' Institution of London organized last year a research committee for the purpose of obtaining accurate records of the action of lightning strokes on buildings. The object in view was to devise, if possible, an improved method of protection, and over 200 competent observers in the United Kingdom, besides a large number in the colonies and elsewhere, were to gather data. Innumerable photographs were taken, which often appeared to reveal conditions which verbal descriptions failed to represent. Out of sixty cases tabulated by the committee up to the first of this year no fewer than twelve relate to buildings fitted with lightning conductors of one form or another. Commenting upon a series of accidents caused by lightning to the factories of some explosive manufacturing companies in Germany, the inspectors state: "These accidents have done much to confirm a feeling of distrust which has for some time been growing in our minds as to the absoluteness of protection afforded by conductors erected in accordance with specifications laid down by the lightning-rod session of 1882." Continuing, the report states that the observed facts go far to confirm the interesting laboratory experiments made by Dr. Oliver Lodge. The committee is continuing its investigations. Members and others willing to assist by reporting their observations are requested to communicate with the secretary at No. 9 Conduit Street, W., London. —Engineering.

FIG. 3.—RESERVOIR AND MAIN PLANT.

PSYCHOLOGICAL APPARATUS.

WE hear much these days of delicate apparatus for the purpose of making measurements in the applied sciences. But little is known of instruments fully as ingenious and fully as sensitive which are employed in the budding science of experimental psychology. The instruments in question are primarily used for the purpose of detecting the rapidity of the transmission of sensations and of ascertaining the intensity of nervous effects.

In order to measure periods of time from 1-20 to 1 or 2 seconds, an ingenious chronoscope, invented by Dr. J. W. Fitz, of Harvard University, is widely used by experimental psychologists. The chronoscope is primarily of service in reaction experiments. In order to test the power of quickly and accurately touching an object suddenly disclosed in an unexpected position, Dr. Fitz has devised what he calls a location reaction apparatus. The subject is required to make a movement of the finger from the end of the nose to one of three positions of an arc of a circle of which he is the center, and the plane of which is at the level of his elbow. The object to be touched is a white spot half an inch in diameter which can be placed at any one of these three positions without the knowledge of the subject. A screen is arranged to fall at the proper time and disclose the spot. At the moment of exposure, an electric circuit is completed by the falling screen, and a record made. When the subject strikes out and touches the white spot he effects another contact, and makes a second time record. With this instrument the effect of training in the baseball field and tennis court is very easily shown. It has been used in the gymnasium at Harvard with considerable success.

In order to measure the intensity of pressure causing pain Prof. Cattell has devised what is called an algometer, an instrument which consists of a spring dynamometer reading up to 15 kilogrammes and having its spring terminating below in a sliding cylinder of brass, capped with a hemispherical piece of hard rubber about 8 millimeters in diameter. The pressure is exerted by the hand of the operator, the instrument being provided with a proper handle or grip.

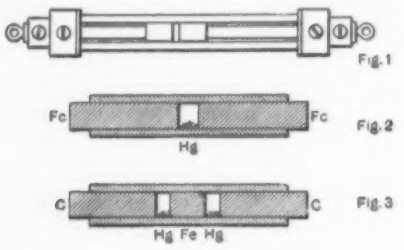
Mosso is the inventor of several psychological instruments of considerable value. His ergograph graphically records the phenomena of work and fatigue. His plethysmograph shows the variations of volume of the arm under conditions of varying environment.

Dr. E. W. Scripture, Director of Yale Psychological Laboratory, has perhaps done as much as any other man to advance the ends of experimental psychology in America. Of the more interesting forms of apparatus which he has devised—interesting from the layman's point of view—may be mentioned a "pistol key," the purpose of which is to show the time lost by a runner after the signal is given. In front of and a little above the muzzle of a small blank-cartridge pistol is a little wing-shaped lever attached to a device clamped to the barrel. This wing is thrown up by the wind from the discharge of the pistol and breaks an electric circuit, by means of which a record is made of the exact time of starting. For the purpose of studying fencing reactions, Dr. Scripture has devised a fencer's foil to the handle of which 6 feet of flexible conductor is attached. A rod having a white disk is used for a signal; to the rod a device is attached which, when moved, breaks a circuit so as to make a record on a drum.

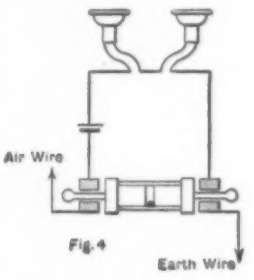
Scripture has also devised an apparatus for recording the least noticeable pressure; a pencil for detecting hot and cold spots; an apparatus for mapping out such spots, and an electrical shoe by means of which the interval between steps, as well as the length of time the two feet remain upon the floor, is recorded. For recording rhythmic action, Dr. Scripture has devised an electric baton, every change of direction of which makes a record upon a drum, and electric dumbbells connected by flexible conductors with a recording drum.

THE CASTELLI COHERER.

SINCE 1898 the Italian naval authorities have carried out a series of experiments in wireless telegraphy with a view to test the practicability of the system as a means of communication between the semaphore stations of the kingdom. These experiments, of which some account is given by A. Banti, in L'Elettricista for May last, were based on the Marconi system, and the results obtained were somewhat disappointing until Capt. Bonomo, to whom the later experiments had been instrusted, tried telephonic reception in combination with a self-decohering coherer invented by Paolo Castelli, an assistant semaphorist. Telephones had already been used experimentally by Popoff, Ducretet and others, but no one

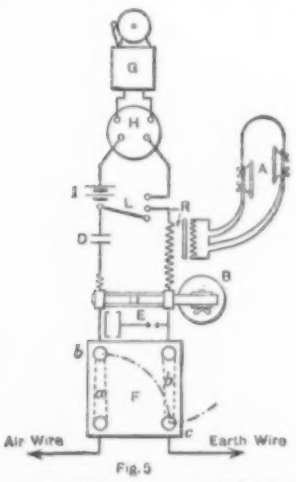


had made use of a suitable coherer such as that of Castelli. Coherers, as is well known, are formed in various ways, the most noteworthy being the so-called powder coherers, which may be made, for example, with silver electrodes and granules of carbon or silver, or silver and nickel (Fig. 1). When these tubes are used it is necessary to tap them for each wave received, in order to "decohere" them and thus render them capable of receiving another signal. But tubes or coherers having iron or carbon electrodes with a drop of mercury between them (Fig. 2) not only have a high degree of sensitiveness, but have the advantage of decohering completely immediately the action of the electric waves ceases. The tube proposed by Castelli (Fig. 3) consisted of two carbon electrodes inclosing two drops of mercury separated by a small



iron cylinder. This tube is self-decohering. When it is used in conjunction with a telephone the receiving apparatus of a station becomes extremely simple (Fig. 4). In practice the receiving arrangements devised by Capt. Bonomo take a somewhat more complete form (Fig. 5), but it is essentially much simpler than previous arrangements.

In practice it insures regularity and rapidity of communication to much greater distances. It was possible to establish a system of signaling between Palmaria and Leghorn with a transmitter giving only 4 millimeters sparks, while telegrams were exchanged between Portoferraio lighthouse and Leghorn, Gorgona and Palmaria, the maximum distance being 143 kilometers. For a good tube, carefully adjusted, the E. M. F. of the cell should be from 1 to 1.5 volts. The



G, Bell. A, Telephones. L, Bell Switch.
H, Relay. B, Induction Coil. E, Lightning Protector.

hygrometric state of the atmosphere has an appreciably injurious effect on tubes which are not perfectly closed. In the mercury tubes the self-decoherence is more or less perfect according to the purity and freedom from amalgam of the mercury used, to the dryness and cleanliness of the interior of the tube, and to the smallness of the drops of mercury. The most suitable diameters of the drops are comprised between the extreme limits of 1.5 millimeters and 3 millimeters. Drops less than 1.5 millimeter in diameter give insensitive tubes; those greater than 3 millimeters diminish the completeness of the decoherence. The diameters of the tubes must be proportional to the drops of mercury used; in general they are 3 millimeters in internal and 5 millimeters to 8 millimeters in external diameter. These tubes must be regulated by the telegraphist on duty, and they lose after a certain time their good qualities, but the telegraphist can discount the tube, clean it, and put in fresh mercury, taking all the necessary precautions for obtaining obsolute cleanliness.

It was chiefly due to the use of the Castelli tube that it was found possible to effect communication with precision and clearness between a station installed at Teialone (Maddalena), and another at the semaphore station of Monte Argentaria, a distance of 200 kilometers (124.3 miles). After these trials the experiments were discontinued, and the two stations were dismantled. The new Castelli coherer in an improved form is stated to have been used by Marconi in his first attempts to signal across the Atlantic.

CHINESE DRUGS AND MEDICINAL PLANTS.*

By AUGUSTINE HENRY, M.A., L.R.C.P., F.L.S. Corresponding Member of the Pharmaceutical Society.

WHEN I was, the other day, reading a paper dealing with the primitive races that exist in the interior of China, Dr. Tylor, the anthropologist, took occasion to remark on the great similarity that is observable throughout the world in the ideas and practices of man in an early stage of culture. Even in the material objects that he fashions for his use the uniformity is striking.

Similarly, in taking up the subject of the materia medica of the Chinese, we are not astonished to find that the plants and minerals employed by them in the earliest times were generally like to, often identical with, those that have been selected as drugs in Europe. There is not even at the present day any great proportion of Chinese drugs fantastic or absurd.

The most ancient herbal of the Chinese is ascribed to a mythical Emperor, called "Shen Nung," or the Divine Farmer, who is fabled to have lived in the twenty-eighth century before our era. He collected medicinal herbs, and tested them in different diseases. The herbal to which his name is attached was current about 500 A. D., and was probably compiled 400 or 500 years earlier. In it 365 drugs were mentioned, evidently one for each day of the year; but in the book as now handed down only 347 are specified, of which 239 are vegetable in origin, 65 animal, and 43 mineral. These are all, of course, native to China; but as centuries rolled on, and intercourse arose with foreign nations, drugs from distant lands came into use, as myrrh, asafœtida, olibanum, opium, and, strange to say, camphor. This process is still going on, and quinine, morphia, and other European drugs have lately obtained an entry into China.

To illustrate the reasonableness of the ancient herbal, and to show its likeness to our own Pharmacopœia, I may adduce some of the vegetable drugs that are mentioned in it in the following brief list: Licorice, rhubarb, gentian, mallow, aconite, madder, ginger, cinnamon, *Croton Tiglium*, *Gelsemium*, *Veratrum nigrum*, *Podophyllum*, *Coptis*, *Cimicifuga*, *Polygonatum*, *Polygala*, *Cannabis*, *Ranunculus sceleratus*, *Poterium officinale*, *Acorus Calamus*, *Polygonum Bistorta*, *Dictamnus albus*, *Tussilago Farfara*, *Leonurus*, *Salvia plebeia*, *Solanum Dulcamara*, *Hyoscyamus niger*, *Prunella vulgaris*, *Artemisia*, *Arctium Lappa*, *Inula*, and iodine-containing seaweeds.

Five principal poisons were enumerated in the ancient herbal of Shen Nung, namely, *Croton Tiglium*, *Veratrum*, aconite, Lang Tu (not yet identified with accuracy), and cantharides. I may here mention that the sale of certain poisons is forbidden by Chinese law, but the druggists evade the law in an ingenious manner: they simply sell the forbidden drugs under another name, e. g., croton seeds are sold as "river seeds," and arsenic as "sincerity mineral." If, however, any fatal effects result from the sale of arsenic, buyer and seller are both decapitated.

The Chinese in their choice of drugs were guided somewhat by the doctrine of the *Signatures*, by which it was supposed that some external mark of the plant indicated its use in some particular disease or symptom. The curved pods of a certain *Gleditschia*, which resemble a boar's tooth, are given for this reason in toothache; while madder, owing to its red root, is supposed to have emmenagogue properties. But beyond such trivial notions, there was unquestionably a great deal of close observation and accurate experimentation, as is evident from the list of drugs that I have quoted above. The acuteness of primitive people, whose minds have not been muddled by indiscriminate book-reading, is remarkable in many directions. The Lolos in Yunnan have a name for almost every tree and herb in the forest; and so keen are their powers of observation they often can tell a tree not by its foliage, but by the appearance of the wood when cut into by the large knife which they carry about with them. They experiment with roots and leaves in cases of chronic illness. In acute illnesses I must admit that they are wildly theoretical. Such they ascribe to the demons and the ghosts of people who have died accidental deaths, who shoot the arrows of disease; and in such cases exorcisms and sacrifice are the remedies employed. The Lolos have a fair knowledge of vegetable dyes, and little in the forest escapes their notice. One of them pointed out to me the remarkable movements of the leaflets of *Desmodium gyrans*, a phenomenon really not very conspicuous, and he advanced the theory that the movements were caused by the vibrations produced by singing in the vicinity of the plant, and that talk had no effect. I understand that the cause of the movements is still a mystery to home botanists.

I will now show two slides. The first represents the primitive loom employed in Yunnan for making cotton cloth of a narrow width. About fifteen feet long can be made by a day's labor on this loom. In this picture is shown a remarkable round hut, such as occurs in certain villages near Szemao. The second picture exhibits a part of the forest near the same place. It shows a very tall plant of *Lobelia pyramidalis*, and beside it my Chinese coolie.

To return to my proper subject matter, it will be impossible for me in the time at my disposal to do aught but glance briefly and in a desultory way at some of the more interesting drugs, such as are noteworthy from their history or economic importance, or from some peculiarities in appearance or use.

I will first speak about *Camphor*, which is not, as might be supposed, a product known to China in ancient times. The tree which produces ordinary camphor, *Cinnamomum camphora*, Nees, was indeed well-known to the ancient Chinese, but only as an excellent timber tree. The camphor which was first known in Europe and to the Chinese was that produced in Sumatra from the *Dryobalanops* tree, what is now known in Eastern commerce as *Camphor baroos*. It would appear that it was possibly through the Dutch or Chinese in their employment that the commencement of the camphor industry in Formosa and Japan originated from the discovery that *Cinnamomum camphora* could yield a product analogous to that of the Sumatran tree. The strong odor of the leaves of the Chinese tree might have led them to this discovery. At present the manufacture of camphor on the Chinese mainland is very trifling, and the world's supply is now a monopoly of the Japanese. It has recently been shown that camphor occurs in large quantities in the young leaves of *Cinnamomum camphora;* and some method of extracting it from the leaves, which could be clipped off the trees, might prove more efficacious than the costly and destructive practice heretofore in use, by which the tree is cut down and chips of the wood distilled. We may then see, perhaps, camphor produced in quantity in districts like the Nilgiris and Ceylon.

A third kind of camphor is obtained by distillation with water from the leaves of *Blumea balsamifera*, D.C. in the island of Hainan. This is costly at present, but the plant is a common weed in many parts of India, Burma and the Straits, and might prove a cheap source of camphor by and bye.

Opium is another drug which has been introduced into China from abroad. The Arabs carried it to China in the ninth century, and it was used for centuries only as a drug in diseases like dysentery. The annual import in 1765 did not exceed 200 chests. It is not known exactly when opium-smoking began; but in 1796 an edict was issued prohibiting the practice, owing to the rapidly increasing number of smokers. This edict was evaded, and by 1820 the import had arisen to 4,000 chests yearly. The Chinese government then took great alarm at two features of the trade: one the economic, the enormous drain of silver from the country which its purchase entailed; the other moral, the debauching of the population. It is not my business here to go into the opium question, but I believe that the Chinese government is sincere in its opposition to the trade, in spite of the fact that it has allowed within recent times the extensive growth of the poppy within its own territory. The native growth was expected to diminish the foreign importation, and so do away with the economic difficulty. The moral question remained the same, whether Chinese smoked Indian or home-grown opium.

There have been many attempts to palliate the evils of opium smoking, but the following facts are worth the consideration of fair-minded people: First, the Japanese government has always steadfastly opposed opium. In Formosa, since that island has become their territory, the Japanese have restricted, and hope eventually to abolish, opium smoking. Yet there was a large population of Chinese smokers, and the import of the drug yielded a large and easily-collected revenue. Second, the Roman Catholic Church in China, as elsewhere, is loath to oppose native practices unless they are radically vicious. In these islands, e. g., it never preaches total abstinence from alcohol, nor has it in China interfered with foot-binding, an inhuman custom. Yet, by a local law of the church, all Roman Catholics in China are forbidden to engage in the cultivation, sale, or smoking of opium. Third, during all my twenty years in China I never heard any Chinese attempt to defend the practice, be he merchant or official, farmer or laborer. It is universally recognized as a great evil, the stress being severest upon the laboring classes, who spend on the drug a large portion of their earnings, and so bring ruin on themselves and their families, too little income being left for food or clothing. Among the richer classes the habit diminishes energy and lowers the moral tone.

The export of opium from India to China is dwindling, and it would be a wise policy for the Indian government to diminish gradually its cultivation, confining it to the quantity necessary for medical purposes. By studying the methods of preparing medicinal opium that are in use in Asia Minor, the Indian government might obtain eventually the legitimate trade of supplying the whole world with most of the opium required for use in medicine. This could be done hand in hand by agreement with the Chinese government, which would, I believe, stop native growth if we withdrew our Indian opium. Every dollar now spent on opium in China would go really ultimately to benefit our trade in other articles.

The bark which I now exhibit is called *Tu chung*, and it is much esteemed by the Chinese as a remedy in cases of excessive perspiration. If the bark is broken across and the parts are drawn asunder, they show the silvery sheen of innumerable threads of elastic gum. The leaves, petioles, and fruit of the tree also exhibit the same feature. The tree which yields this strange bark was known to the Chinese in the earliest period of their history, but it was only recently that botanists became acquainted with it. It was discovered by myself in plantations in Hupeh, and has been described as a new genus, *Eucommia*, in the small Eastern order Trochodendraceæ. The gum is a sort of gutta percha, and the microscopical structure of its containing cells has proved of great interest. The tree grows in the cool mountain regions of Central China, and it may turn out of economic importance as a possible source of gutta percha, a source available in temperate countries.

Another curious Chinese product, not however a

*Communicated to the Pharmaceutical Society, at a meeting held in London on Tuesday, April 15, 1902.

drug, is this wood, which is derived from a laurel, *Machilus Thumbergii*, S. et Z. Shavings of it steeped in water exude a clean gum, which is used by Chinese ladies as bandoline, and by its use they keep their hair smooth and glossy.

I will show the receptacles of *Ficus pumila*, L., specimens which were procured by men in Formosa. In that island an excellent jelly is made by steeping them in water; a little sugar is added, and a pleasant summer food is thus obtained. The receptacles are also met with in drug shops on the mainland. Steamed, they are used as an application in painful piles. This plant is remarkable for its dimorphic leaves. In the barren stage it creeps over the surface of rocks, covering them with a continuous layer of minute leaves. When it takes on the fruiting stage it pushes out horizontally or obliquely from the surface of the rock, branches which bear very large leaves and fructifications. In the one stage the leaves are only half an inch or so in length; while in the other they are as much as three inches long. The differences between the two stages in habit and in the size of the leaves are very peculiar.

Everyone has heard of *Ginseng*, which is so valued by the Chinese as a tonic in cases of chronic illness; and, as is well known, there are two main varieties, one produced in Manchuria, Japan and Corea, and the other in the United States and Canada. There are certain differences between the plants, which are, however, kept together in the "Index Floræ Sinensis" as *Aralia quinquefolia*, Pl. et Dene. A great number of additional specimens of wild forms of plants closely resembling ginseng have been sent by me to Kew from both Hupeh and Yunnan. In eastern Yunnan and western Kwangsi, one form is cultivated; but the rhizomes are not recognized by the Chinese as a kind of ginseng. They are called *San-ch'i*, a drug to which is ascribed entirely different properties. *San-ch'i* is much valued as a sovereign remedy in all cases of external wounds and hurts, and is always carried about by military officers on active service. The plant yielding this drug was unknown till I obtained specimens lately in Yunnan, and it is very remarkable that the two most esteemed drugs in China, one in medical, the other in surgical cases, should turn out to be so closely allied. In addition to these forms in China, there are others met with in the Himalayas, which have been hitherto grouped together as *Aralia Pseudo-ginseng*, Benth. Mr. Burkhill has studied the whole group, but his paper has not yet been published. He distinguishes the form which yields the valuable *San-ch'i* as *Aralia quinquefolia*, var. *noto-ginseng;* but it will, I think, eventually be considered more convenient to look upon it as a distinct species.

The *San-ch'i* plant occurs wild in the forests of Yunnan over a wide area, but the drug is mainly produced by cultivated plants, which are grown by the strange aboriginal race called the Yao. The Yaos inhabit, in isolated villages, the high mountains of southern China and Tonkin. They always live on the verge of primeval forest, and in addition to being expert hunters, they generally cultivate *San-ch'i* and the species of *Strobilanthes*, which yields the indigo used in these parts. The *San-ch'i* is grown in forest clearings. The plants are protected from the glare of the sun by rude stagings, such as will be described by me in connection with the next drug. I found the Yaos pleasant and agreeable people, and I will now show a slide which is a photograph of one of their villages perched on the verge of a mountain forest near Szemao. The next slide shows a lane in the village. Another slide represents a boat crossing the Nanban River, one of the tributaries of the Mekong.

Huang Lien is one of the most important drugs in use among the Chinese, and the plant producing it was discovered by me in Hupeh, where I paid a visit to a plantation. I remember very well the day on which I made the visit, as it was the most fatiguing excursion I ever went upon. The night before I had spent in a log hut at 8,000 feet altitude, and the way down to the plantation, some 2,000 feet lower, lay along a torrent bed; the descent was perilous, as we had to lower ourselves, my coolies and myself, from rock to rock in a cautious manner. It rained all day incessantly, and on our return we took a false path, and had to descend again and retrace our steps, finally reaching the summit of the mountain by a second ascent. *Huang lien* is cultivated in forest clearings, exactly in the same way as *San-ch'i*. The plantation was a plot of ground, some 400 feet long by 400 feet wide, over which was erected a staging, made by stakes four feet apart and three feet high, over which were laid branches of trees. In this way the sun's rays only reached the plants in a glimmering way. The plants were raised from seeds; then the young plants of a year's growth were transplanted, and allowed to grow under the staging for eight or ten years, until the rhizomes had attained the necessary size.

Huang lien, cultivated in Hupeh, has been described by Franchet as a new species of *Coptis*, namely, *Coptis chinensis;* but he admits that the foliage is absolutely identical with the Indian plant, *Coptis teeta*, Wall, which grows in the Mishmi Hlls in Assam, and the roots of which make their way, packed in tiny baskets, to Calcutta. I have been at some pains to examine the specimens at Kew and the literature on the subject, and I find that considerable confusion has been occasioned by a figure of Griffith's, which is called *Coptis teeta*, but which is not a *Coptis* at all, as he himself admits. The figure given in Volume V., plate 114, of the "Annals of the Royal Botanic Garden, Calcutta," of the plant which is considered by Brühl to be *Coptis teeta*, Wall, agrees absolutely with Ford's specimen of *Huang lien* from Kwangsi. There is not sufficient material at Kew to decide whether or not Franchet's specimens are the same as this; but I doubt very much, in spite of the slight discrepancy in his description of the flowers, whether his new species, *Coptis chinensis*, can stand; and it is probable that all the Chinese specimens in the Kew Herbarium are *Coptis teeta*, Wall.

Huang lien from China is imported into Bombay, so that in India both Assam and Chinese Coptis are employed.

In the Chinese drug shops may be seen the rhizomes of *Picrorrhiza kurroa*, Royle, a Himalayan plant. These are called *Hu Huang-lien*, i. e., Tartar *Huang-lien*—and they are imported into China via Tibet. Rockhill mentions this drug as a product of Lhasa.

Rhubarb is a very important Chinese export. Strange to say, its origin is not yet clear. The only dried specimens of a *Rheum* producing rhubarb for the foreign market in China itself which have reached Europe were obtained by me in the mountain forests of Hupeh at 7,000 to 10,000 feet altitude. These have been identified with *Rheum officinale*, Baillon. I observed this plant growing in the forests, in the soft decaying vegetable matter of ages; and it had horizontally-growing roots, some three or four feet long, about four inches in diameter at the larger end, with a broad cortex, but golden yellow on section. Traders came to this locality and bought the dug-up roots from the mountaineers. These were carefully pared and cut up into pieces, which were pierced with holes made by box-wood pins and then dried in the sun. There is no doubt that this species does supply a part of the rhubarb of commerce. Further west, on the frontier of Tibet, at Tachienlu, there is a large production of rhubarb for the foreign market; but two of my friends who were there failed to obtain specimens of the plant, although they collected botanical specimens. I asked them why, and they replied that they did not gather any specimens of the rhubarb plant because they thought that such a well-known plant would be of no interest.

The great seat of the rhubarb trade is at Hankow. A portion of the rhubarb met with in this great market comes down the Yangtse from Szechwan and Tibet via Ichang. Another part apparently comes overland, or down the Han River from Kansu and Shensi. The great interior market of rhubarb is Sining, in Kansu, and an immense quantity of the drug is collected in the mountains around that city, and in the vicinity of Lake Kukonor. Rockhill says a very fine quality is dug up on the mountains south of Shang, near the same lake; but he did not observe rhubarb growing wild till he reached much further south in Tibet, in the country west of Batang. Pratt says a great deal is collected at Ta-chien-lu, where it is dug up, being simply sun-dried and pierced with holes, not scraped. It is sent on from there to Sining, where it receives a second treatment, being dried again after being thoroughly scraped.

Bretschneider ("Botanicum Sinicon," II., p. 231) holds that Prezewalsky discovered in 1872 the plant yielding the drug in Kansu, which turned out to be *Rheum palmatum*, var. *tanguticum*. Another species from Szechwan and southeast Tibet, from which a great part of the best Chinese rhubarb is derived, was obtained in 1867 by the French missionaries and sent to Paris, where it was cultivated, and described by Baillon as *Rheum officinale*.

Maximowicz, in a letter to Kew, says that *Rheum palmatum* occurs in western Kansu (called Amdo), but that in eastern Kansu a different species occurs, collected only in leaf by Potanin, which is probably *Rheum officinale*, Baillon, or *R. Pichonii*, Pierre. The last-named species is possibly the same as *R. officinale* (see "Index Floræ Sinesis," II., 354). Maximowicz believes that both kinds reach Sining, and that formerly both yielded Kiachta rhubarb. He further adds that *R. rhaponticum* of the dry steppes of Daurre is found to be equal to and as good to use as the Chinese rhubarb.

Rockhill points out that the medicinal properties of rhubarb are scarcely known to the Mongols, who use the root as a dye to color yellow the hats, boots and clothes of the Llamas.

According to Mr. Holmes, neither *R. palmatum* nor *R. officinale* yield a drug exhibiting the peculiar markings of the best Chinese rhubarb, and this would go to show that there is a third species still unknown.

*Rheum officinale** occurs at Ta-chien-lu, from which district it was sent by the French missionaries in 1867; also, apparently, in Nan-ch'uan, to the southeast of Chungking, and in Fang District in Hupeh.

Rheum palmatum† is recorded from western Kansu. In these great regions there is room for a third species to occur, and I would point out that efforts ought to be directed toward obtaining specimens of the plant growing in eastern Kansu and Shensi, because this is the most likely locality for the third species to occur. From there it would go to the great central market of Sining; and this is Shensi rhubarb.‡

Apparently no rhubarb is now exported from Canton or Tientsin; all comes down the Yangtse from Hankow.

In the same mountainous regions of Hupeh I came across the cultivation, if it may be so termed, of the fungus which is called *Mu-erh*, and is so much esteemed as an article of food by the Chinese. This is *Hirneola polytricha;* and Mr. Massee informs me that this species and *H. Auricula-judae* are only geographical forms of one cosmopolitan species. Trees are cut down and allowed to lie rotting on the ground for a year. They are then sawn into short lengths and erected into shed-like structures in the opener parts of the mountains. The spores floating in the air alight on the decaying bark and give rise to the *Mu-erh*. In some localities edible mushrooms appear on the sheds instead; so that one side of a mountain may be famous for its *Mu-erh* and the other side for its mushrooms. Some Chinaman discovered this fungus in New Zealand, and a large importation used to occur from there into Hongkong for the Chinese market; but I hear that the supply in New Zealand is becoming exhausted.

Lysimachia Foenumgraecum, Hance, is a curious herb, very common in the forests of Kwangsi and Yunnan. When growing, it has no smell whatever, but the leaves, when dried, emit a strong odor of fenugreek. They are used to scent hair oil, and as much as thirty-six tons of the leaves, valued at £2,400, are annually exported from Canton to other parts of China. Hance says that the leaves are not only used to odorize hair oil, but that they are also molded into beads and used medicinally.

Dioscorea rhipogonoides, Oliver, occurs in Formosa, South China, and Tonkin. The tuberous root, called Dye Yam, is used in Canton and elsewhere as a dyeing and tanning material, for preserving fishing nets, for example, and dyeing certain cotton fabrics. The export from Tonkin to China is enormous, and this product is exceedingly cheap. Its properties are well worth investigating in this country.

I will now show a peculiar *Extract of Tea*, which is made in the office of the Prefect at Szemao, whence it is sent to Peking as tribute for consumption in the Imperial Palace. This extract is obtained by repeated decoctions, and analysis shows it to contain 6.1 per cent of caffeine and 12.7 per cent of tannin. The Shan States, east of Szemao, produce a tea of a rough flavor, which is generally made up into circular cakes. The Tibetans come to Szemao and buy considerable quantities of this tea, while the rest makes its way to all parts of China, where it is esteemed as having some vague medicinal quality.

In connection with the commerce and traffic of the interior of China I may now show some slides. This one represents the Custom House at Szemao, which I had charge of for nearly two years. The cargo, which is generally carried by pack horses and mules, seen in the picture, is cotton from Burma. The pack-saddle used is most ingenious, and is well shown in this slide, which represents a pack horse as employed by the French army in Tonkin. On the saddle rides a wooden frame, and to this frame are lashed boxes or other packages. The frame, with its packages, is easily taken off or put on the animal; and the weight is capable of the nicest adjustment, and never presses on the sides of the animal, as it does in other kinds of packs where the cargo is lashed to the saddle itself. The next slide shows pack oxen crossing a bridge near Szemao. Such bridges are made by the Shans over small streams. A much more elaborate bridge is shown in the next slide—the Iron Suspension Bridge, over the Black River, on the way between Szemao and the capital of the province, Yunnan-fu. This bridge is made of iron bars and links, stretched in chains from pier to pier. It was constructed by a Chinese blacksmith.

The principal Chinese soap trees are *Gymnocladus chinensis*, Baillon; various species of *Gleditschia; Sapindus Mukorossi*, Gaert.; and *Pancovia Delavayi*, Franchet. Their fruits contain saponin in quantity, and will provide a cheap source of this substance, if it is required in our manufactures. The seeds of *Camellia sasanqua*, Thunb., are crushed to yield the so-called Tea-oil, and the refuse-cake contains saponin, and is used by the Chinese for cleansing fabrics and as a hair wash. At Hongkong, a diluted decoction of this cake is used for destroying earthworms in grass lawns.

Mr. Ford's researches have shown that cassia bark is derived from *Cinnamomum cassia*, Bl. We are still, however, ignorant of the botanical origin of two other cinnamon barks. One is the thick and extremely dear bark so much esteemed by the Chinese as a medicine. It makes its way into China from French Laos, being carried by peddlers across the Red River northward into all parts of China. The other bark is the so-called *Saigon cassia*, which is a regular article in the New York market. It is imported thither from Hongkong, but it comes to Hongkong from Annam, and is not a product at all of Saigon or Cochin China. I have a report presented to the Hanoi Chamber of Commerce in 1897, and from this report it appears that this bark is cultivated in the wild mountains of Annam by the savages, who are called *Moi*. In 1896 the export from Annam was 241,000 kilos. The tree producing this bark is said to occur wild in the mountain forests of Annam, but the commercial product is all derived from the gardens of the savage Mois. The same report mentions the occurrence in other districts of Annam and Tonkin of a wild cinnamon tree, the bark of which is fifteen or twenty times dearer than the cultivated kind, and this goes in part northward into China. This is evidently the valuable cinnamon which is carried by peddlers across the Red River.

True *Star Anise*, the product of *Illicium verum*, Hk. f., only occurs in Kwangsi and Tonkin. In Japan *Illicium Anisatum*, L., produces poisonous fruit which closely resemble the true fruits. An enormous quantity of this poisonous fruit is imported into China from Japan, and I have never been able to find out how it is used, unless it be as an adulterant of the true star anise, which is used as a condiment with meat in China.

The difficulty of clearing up obscure points like the one just mentioned, and also of finding out the origin of drugs and other products, is very great. I have been fortunate enough, however, to come across in my wanderings in China many of the plants which are used as drugs, etc., but I cannot now give a detailed list of these discoveries. Mr. Holmes has also eliminated many difficult questions. He has shown—e. g., to mention only one—that Chinese cubebs are derived from *Litsea citrata*, Blume. A similar tree, *Litsea pungens*, Hemsley, yields in Hupeh fruits which are called "mountain pepper" by the Chinese. They are salted and eaten as a condiment. *Huang po*, a yellow bark used as a dye for silk fabrics, has been shown by Mr. Holmes and myself to be the product of *Phellodendron amurense*, Rupr.; and the Japanese, who were in error concerning this bark, have adopted this identification in their recent publications.

I will now say a few words concerning botanizing, which has been the occupation of my leisure time in China for many years, and has resulted in vast collections of dried plants. It would be of interest to bring before you some of the wonders of the great forests of the interior of that great country; but I can now only allude to one or two points. I consider that we are very ignorant still of the upper surface of the forests, that exposed to the outer air, and we shall remain so till navigable balloons are invented, in which we might skim over the tops of the trees. It is useless to try and cut down trees, as they will not fall, and their ascent is often impossible. Huge lianas often extend from the ground to the summits of the tallest trees; and I have seen a rose with a stem over six inches in diameter, which extended like a great

* *Rheum officinale* occurs between 30° to 32° N. lat., from 97° to 111° E. long.

† *Rheum palmatum* occurs between 36° and 38° N. lat., and between 99° and 103° E. long.

‡ Shensi rhubarb is further east to 111°, between the same parallels as the Kansu rhubarb.

cable for 200 or 300 feet, and flowered high up above the trees. In southern China hosts of orchids, ferns, and other plants live on trees. As all plants cannot reach the summit of the forest, we observe the curious phenomenon often that the flowers are borne on the old wood on the stems below the leaves, and in this way insects are able to approach the flowers from underneath, as it were. Flowers appearing before the leaves is another very common phenomenon. A good example of this is the *Bombax* tree, shown on the slide; in flower it rather resembles an artificial candelabra than a natural object. The next slide shows a *Ficus*, which is on the Mengtse plain; it illustrates well the enormous size which some trees attain. Another species of *Ficus* is now shown in this slide. It quite differs in habit from the last, being as scanty in foliage as the other is luxuriant. The next slide shows the *Mahe*, a primitive people living near Szemao. They are perhaps the best-looking of the aborigines, yet they are rather low in the scale of civilization. Earth-eating is one of their practices. The last slide shows the way in which charcoal is made in the forests near Szemao.

My remarks have been somewhat desultory and disconnected, but the subject scarce admitted of more logical treatment in the time at my disposal. Now, nearing the end, like the story-tellers, I may point a moral. We have seen how important have been certain exports to China, as ginseng from America and fungus from New Zealand. With some enterprise this list might be greatly extended. Many of our colonies and possessions yield products which would have a good sale in China. It might be possible, indeed, to cultivate certain drugs for the Chinese market. The pseudo-ginseng of the Himalayas might, e. g., be saleable in China. For such work, of course, Chinese, acquainted with native methods of drying, cultivating, etc., would be necessary.

Another important question is the converse of the preceding, the utilization by ourselves of the many important vegetable substances which occur in China. I have mentioned the fruits containing saponin. I might now draw attention to *wood-oil*, which is yielded by the seeds of *Aleurites cordata*, M. Arg. The native boats on the Yangtse are brushed over with this oil, which looks well as a varnish, and preserves the wood. There is a great variety of substances yielding tannin, as certain acorn-cups, the cones of *Platycarya strobilacea*, S. et Z., etc. In another place, lately, I alluded to the importance of attending to the intensive modes of cultivation which prevail in China. In a word, there is much to be gained from scientific exploration of China, and this should be carried out, in my opinion, by well-planned expeditions of men carefully trained in the different departments of science and art.

[Continued from SUPPLEMENT No. 1390, page 22276.]

THE HARPOON—FOREMOST AMONG SAVAGE INVENTIONS.*

By OTIS MASON.

THE last word has been said with reference to the barbed harpoon—it might be called the first chapter in this interesting history.

The second chapter is concerned with what has been termed the toggle harpoon. In Figs. 6 and 7 will be seen the simplest form of this apparatus, having a wide distribution on the west coast of America from Mount Saint Elias southward to California. The Venezuelan Indians came very near discovering or making this wonderful improvement. They have

FIG. 6.—TOGGLE HARPOON. HUPA INDIANS, CALIFORNIA.

the shaft, the hard foreshaft, the socketed head and the connecting line. If it had only occurred to one of these ancient inventors to substitute the terminal barb for the knob at the inner end of the head the thing would have been done. This very simple but effective apparatus shown in the figure contains the elements of the most elaborate toggle harpoon—the piercing blade or point with its tang, the side pieces with barbed extremities fitting onto this and furnishing at the same time a short socket, the lashing of sinew or other tough cord, the covering of smooth pitch, and the rawhide leading-line are all that is necessary for the effective togglehead harpoon. Turn now to Fig. 7 in order to understand the method of action. The head is placed upon the wedge-shaped end of the foreshaft, the line is drawn tight, the fisherman, as shown in Fig. 8, is standing on a rock in

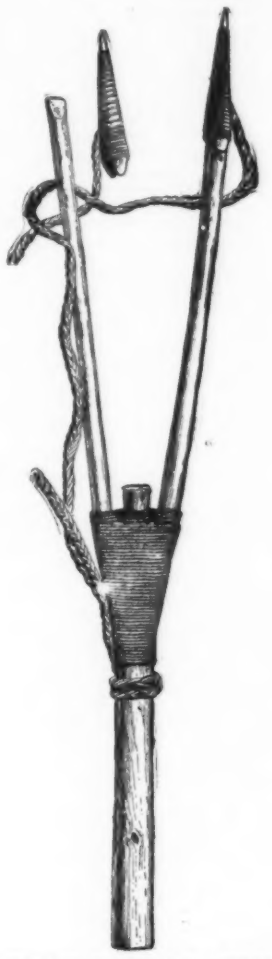


FIG. 7.—TOGGLE HARPOON. THOMPSON INDIANS, BRITISH COLUMBIA.

Am. Mus. Nat. History, N. Y. After James Teit.

* Abstract from a Bulletin Published by the Smithsonian Institution.

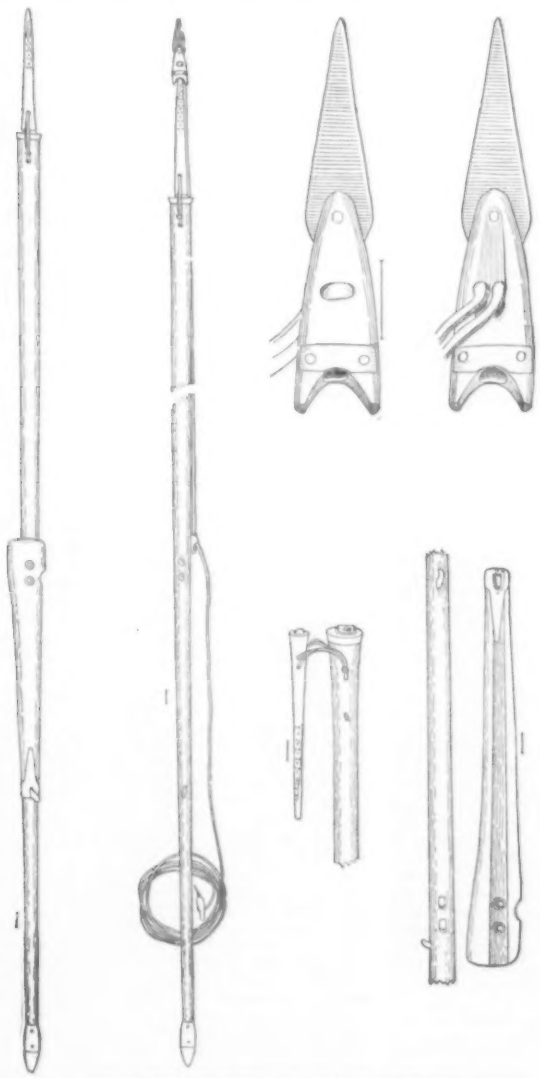


FIG. 9.—TOGGLE HARPOON, EAST GREENLAND.

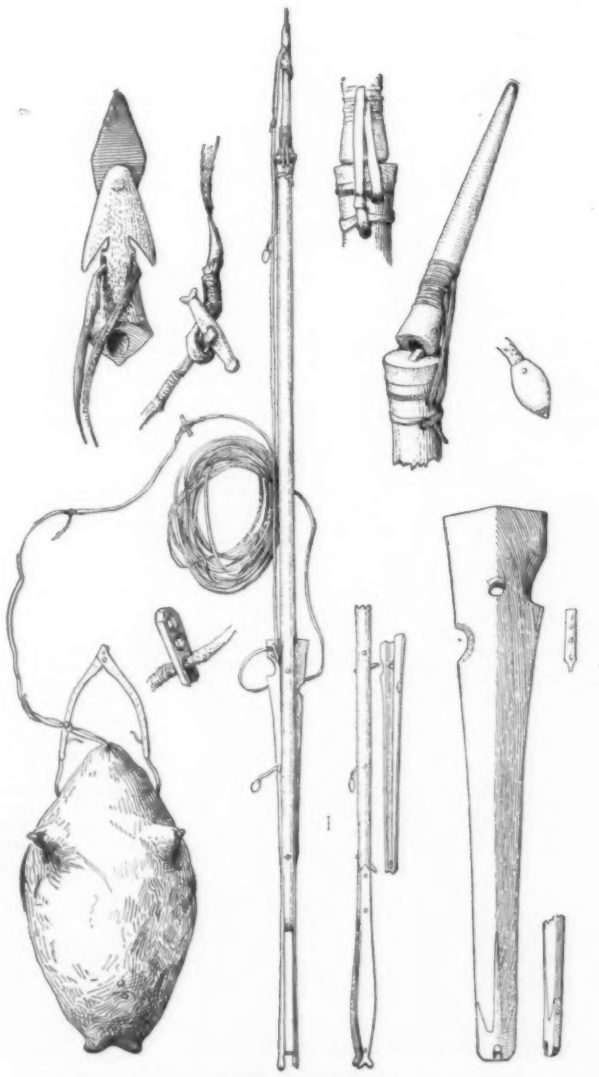


FIG. 10.—THE WEST GREENLAND HARPOON.

a cascade or, perhaps, upon a stage which he has erected in the middle of the stream, the salmon are running, he plunges his harpoon into the writhing mass, two fine victims are struck and the head of the harpoon is driven into their bodies. When the shaft is withdrawn the head toggles inside of the animal and nothing can release the hold unless the entire side of the fish is torn away. There is no escape from the toggle head harpoon. If the fish were able to wrest the immense shaft from the hands of the fisherman it would do them no good; they could never disengage themselves from the grip of the toggle.

A careful study of this very simple but widely spread form of the toggle harpoon prepares the way for the Eskimo varieties, which are the most complicated and effective in the world.

Fig. 9 is a study in the apparatus of the eastern Greenlanders, so graphically described by Nansen in his charming work, "Across Greenland." The blade, the body, now a single piece of ivory, the rawhide line, and the socket are all shown in the drawing. But especial attention is called to one feature, which is really a new and ingenious invention—let us call it the loose or hinged shaft. The outer end of this loose shaft fits into the socket at the butt end of the toggle head; the inner end is flat, with the exception of a little projection in the middle, and the foreshaft on the end of the shaft is also flat on top, with the exception of a small cavity corresponding with the projection on the inner end of the loose shaft. The loose shaft, as will be seen, is perforated near its lower end in one or two places as the case may be. Similar perforations are made near the end of the shaft. Through these a stout and elastic rawhide line is passed two or more times and fastened tightly in position. The action of this rawhide joint or connecting line is that of very rigid india rubber—when the loose shaft is brought into position the line holds it firmly there. Notice again that the toggle head is placed on the outer point of the loose shaft and the line is drawn tight and buttoned over an ivory peg projecting from the middle of the shaft. This holds the head firmly in place. On the shaft also will be seen three ivory pegs in a row which fit into perforations through the throwing stick, or casting board, by means of which the harpoon is hurled. On the butt end of the shaft is an ivory knob, which may serve the hunter for the point of the alpenstock. On the end of the line is a toggle or button so that the animal will not be able to wrest the line from the hunter's hand. When all these parts are in place the hunter thrusts, with all his force, the head of the harpoon into the animal, sometimes striking a vital part. When one of these immense creatures is writhing in the agony of pain the head of the harpoon is twisted from the loose shaft, the other end of which is bent out of its socket, as shown in the figure, to prevent breaking. It will be seen that this joint, therefore, is of the very greatest benefit. The line is pulled from its little button or peg, the outer end being held in the left hand, and with the right hand the shaft is laid upon the ground or in the canoe, and the game is played with, or, by means of the line it may be hauled in or let out at the pleasure of the hunter. To enumerate the inventions in this East Greenland harpoon you have the metal blade, the solid head, protected by a riveted band; the socket in the middle of the base, the rawhide line passing quite through the harpoon head, but protected by a countersink between the two perforations; the line drawn down and fastened over a peg on the shaft, the toggle on the end of the line, the flat, elastic joint between the foreshaft and the loose shaft, the pegs on the shaft for the accommodation of the throwing stick, the sharp ivory prod on the end of the shaft to aid in walking, and, finally, the throwing stick itself which, in the Greenland varieties, instead of being hooked to the end of the shaft, fits over a series of pegs.

FIG. 8.—HOW THE TOGGLE HARPOON IS USED.

The West Greenland harpoon complete is shown in Fig. 10. Without being tedious, I shall call attention to one or two features in this series of a most interesting character. The blade of the harpoon head is of metal, the body has perforations for the line, a socket for the foreshaft, and it is also a most delightful survival of the old days of the barbed harpoon. Here then is a combination of the old and the new—the barbed harpoon turning into the toggle harpoon. A few other features may be mentioned—a joint between the foreshaft and the loose shaft, the end of the shaft imitating the feathers of the ancient arrow of the Eskimo and having no function whatever, and, instead of a toggle on the end of the line, there is a sealskin inflated. When the game is struck and the shaft withdrawn and laid on the deck of the canoe the hunter immediately throws the sealskin buoy overboard and he knows the position and movements of his game by following this as it bobs about on the water.

In a large collection of harpoon heads from Western and Northern Greenland in the United States National Museum a great many of them have this survival of the ancient days when only harpoon heads with lateral barbs were used, the toggle or terminal barb and the hinged devices being added subsequently.

The Labrador Eskimo do not put a sealskin bag or float on the end of the line, but instead attach a piece of board or flat block of wood to the end of the shaft, which serves the same purpose of a drag to impede the progress of the animal. In this they anticipated by I do not know how many centuries all our logs and other contrivances for rating speed of ships.

The central Eskimo living about the northern and the northeastern portion of the Hudson Bay have been studied most carefully by Dr. Franz Boas, and a detail illustration of their harpoon is shown in Fig. 11. It can be easily imagined that the essential feature in an apparatus so complicated would be the certainty and ease of the working of each part. If the Eskimo have a decided craze for anything it is for

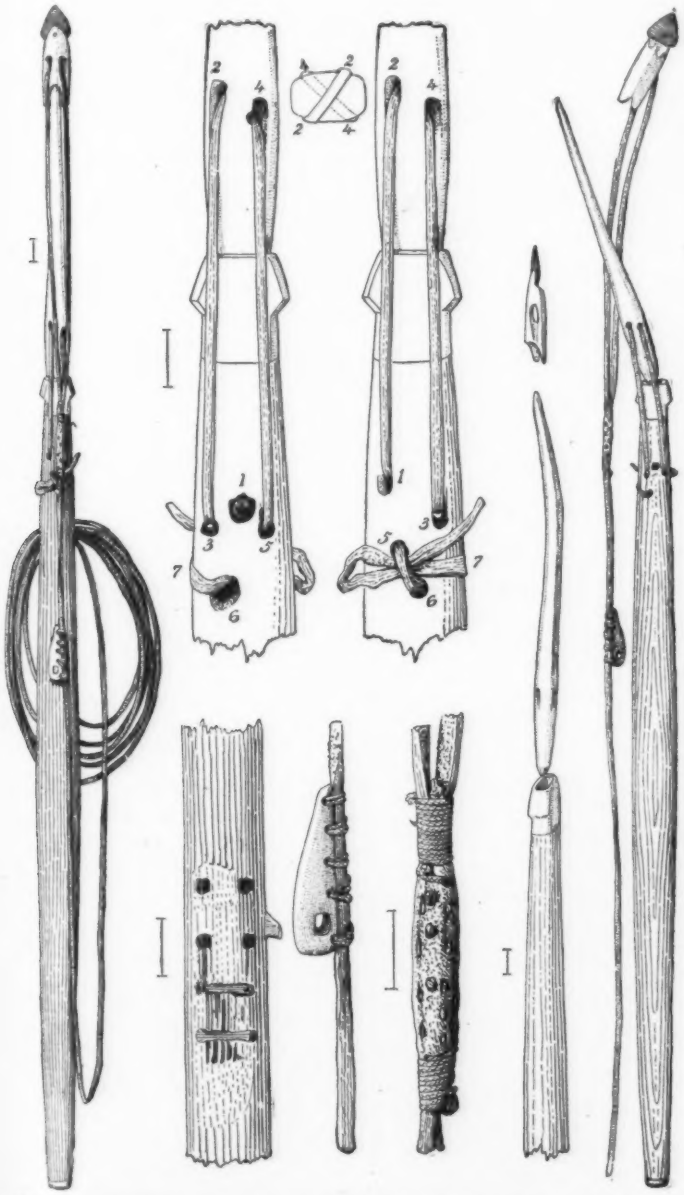


FIG. 11.—COMPLETE SEAL HARPOON, CUMBERLAND SOUND.

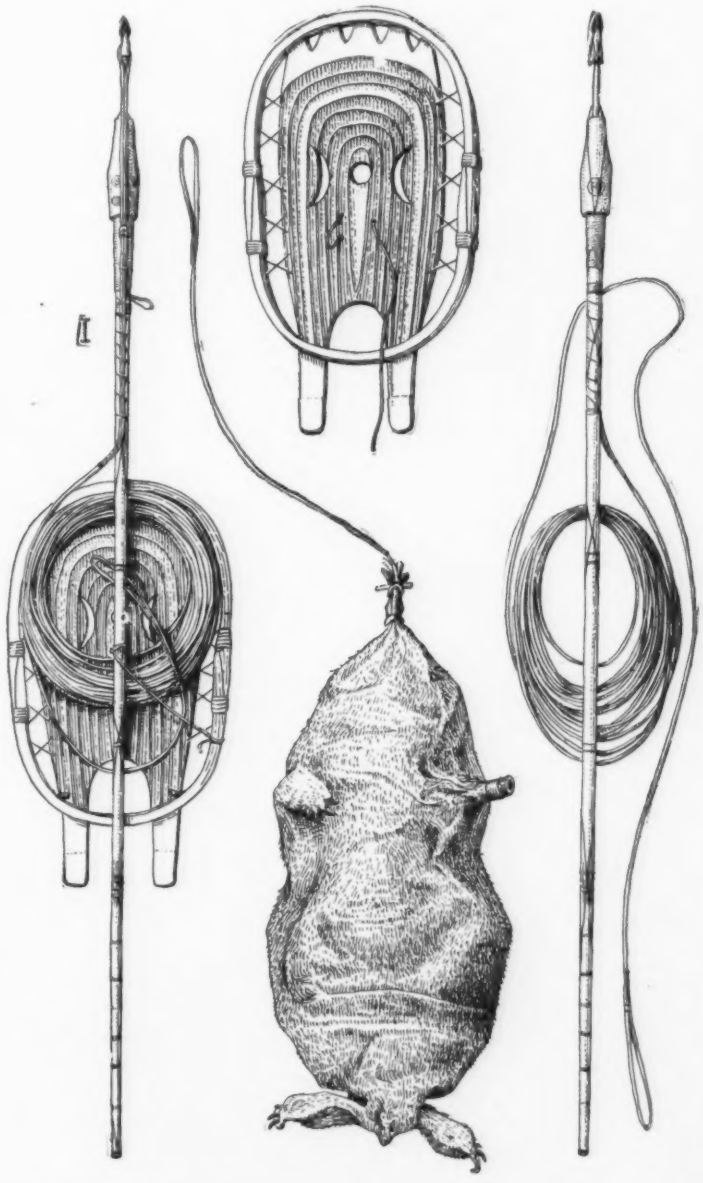


FIG. 12.—TOGGLE HARPOON, LINE AND FLOAT, KUSILVAK, YUKON RIVER.

boring holes. Instead of living in the stone age or bone age they might be said to have created the drill age. The figure on the right shows the shaft, the ivory foreshaft with its socket, the spindle-shaped loose shaft with its elastic hinge or walrus hide, the toggle head with blade of iron and body of rawhide, and the line. Attention is called to the peculiar method of splicing rawhide adopted by these savages. The end is taken through the line hole of the toggle head, brought back and securely fastened to the body of the line by means of seizing at each end of the joint and a through and through sewing with braided sinew cord. The method of constructing the elastic joint of walrus hide is also illustrated carefully by the drawings in the middle of the picture. The attachment of the eyelet on the line is also shown. In order to set the harpoon for action this little device is first buttoned to its pin or peg on the shaft, and the end of the loose shaft is placed in its socket on the foreshaft, the socket of the toggle head is fixed in position, and by a sudden pull the whole is straightened up tight and ready for action.

There is a feature in the harpoon of which I have not yet spoken. I mean the ice pick. It does not exist on all harpoons, but is found in excellent form upon the retrieving weapon used by the Eskimo at Point Barrow and Alaska, and figured by Mr. John Murdoch, naturalist of the Ray Expedition. The other characteristics of this Point Barrow specimen are similar to the same parts of harpoons in other regions.

The ice pick is essential to the Eskimo in retrieving his seal when struck through a breathing hole or on the edge of an ice floe in the open water. It is necessary in the first instance to enlarge the breathing hole so the animal can be drawn up into the open air; in the other case the edge of the floe is not strong enough to bear the weight of the hunter.

It is in the waters of the Bering Sea that the daintiest of toggle harpoons have been developed. This grows out of the fact that most of the animals hunted are smaller than those in the eastern waters. In Figs. 12 and 13 the entire combination of inventions will be shown. On the left of Fig. 12 the harpoon is in place on the deck of the kaiak; the toggle head is fitted to the loose shaft which is hinged to the carved and heavy foreshaft; the line is drawn tight and rolled up on the line rack which slides at its inner ends under the rawhide thongs across the deck of the canoe; the sealskin bladder is inflated ready to be thrown overboard to do its work. Fig. 13 shows the harpoon dissected and the manner of socketing the parts and joining the lines by means of knots. After this comes the trader who will imitate the beautiful carved ivory heads and foreshafts in cast iron and sell them to the Eskimo for a song. The poetry has gone out of the art and our interest in the invention ceases.

Besides the parts of the perfected toggle harpoon just enumerated there are any number of accessories. First of all, every article of the hunter's dress must be modified and adapted to the harpoon—his double boots, his mittens, his hooded parka or coat, his waterproof mackintosh, made from the intestines of aquatic animals, his visor, snow goggles, and hooded hat have reference to this implement. Again, his dainty skin boat or kaiak is built for the harpoon, and the necessary accompaniments on the deck are all sorts of buttons and attachments, racks to hold the weapon itself, the dispatching spear, the line, the inflated sealskin, and the paddle.

To ascertain whether the seal is already at the breathing hole a rod of wood or ivory is let down through the little opening so that the nose of the animal pushing against it will indicate to the hunter that the game is near. The wooden tripod or stool on which the Eskimo stands in order to be off the ice must be added to the list, also the curious and ingenious methods of quickly attaching the detached parts of a line without untying a knot, and the artificial foot of the seal made by fastening the claws of a dead animal to a trident of wood. With this the hunter scratches on the ice and the moment the male or female seal hears the noise it comes to join its companion. Scoops for removing the chipped ice from the breathing hole, the throwing board or stick for projecting the seal dart, toggles and bandoliers of rawhide and ivory for dragging the seal home, after it has been dispatched, and more are all called into being and perfected on account of and are subsidiary to the harpoon.

The harpoon passed from the hands of the savage man into those of the civilized man, who added the iron blade, steel ice pick, and, in a few other parts, substituted metal for stone, ivory and wood.

When the rage for sperm oil had increased to its highest pitch we even read of harpoon heads armed with the most virulent poisons such as prussic acid, and also of the substitution of cannon for throwing sticks in lancing explosive bombs into the intended victim. The discovery of coal oil, however, relieved the pressure of this situation and allowed the savage form to endure unchanged to the present day.

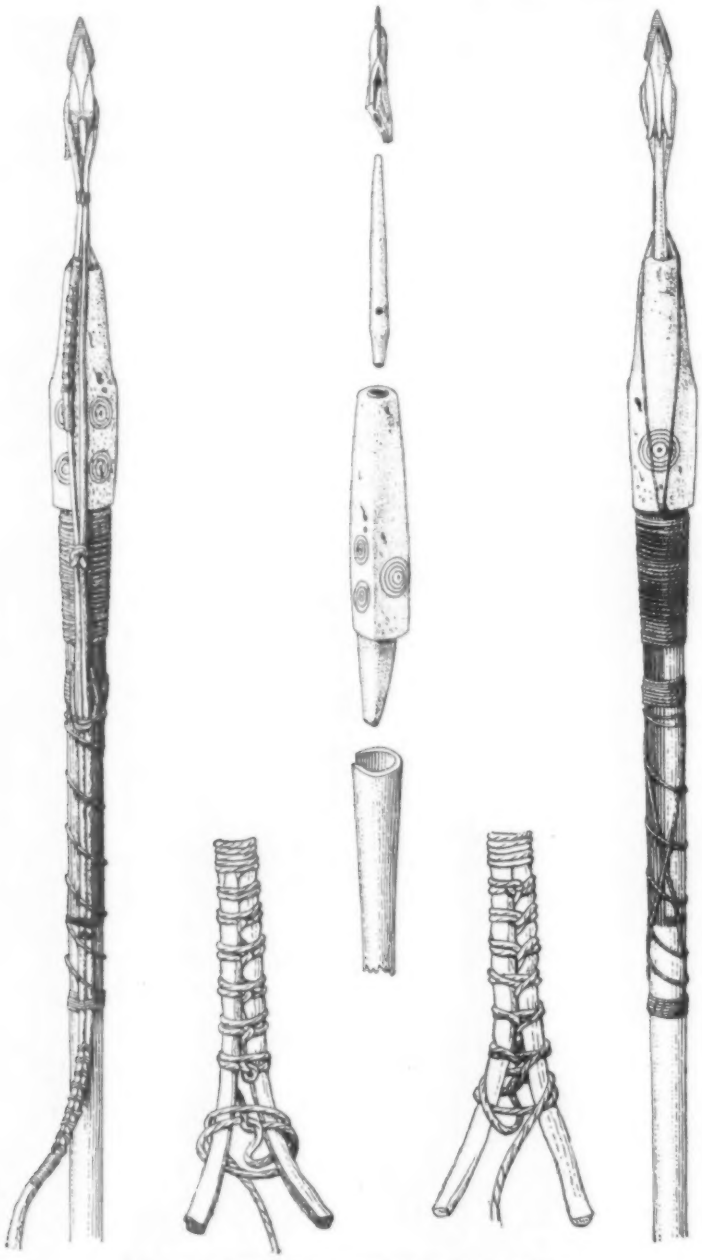


FIG. 13.—DETAILS OF KUSILVAK HARPOON.

TRADE NOTES AND RECIPES.

Production of File Alloys.—Owing to the great hardness which is peculiar to many copper-tin alloys, the latter are also employed for the making of files, which in distinction from the steel files are designated composition files. According to the "Metallarbeiter," such alloys have the following composition:

GENEVA COMPOSITION FILES.

	I.	II.
Copper	64.4	62
Tin	18.0	20
Zinc	10.0	10
Lead	7.6	8

VOGEL'S COMPOSITION FILES.

	I.	II.	III.
Copper	57.0	61.5	73.0
Tin	28.5	31.0	19.0
Zinc	78.0	——	8.0
Lead	7.0	8.5	8.0

Silver-Gray Stain for Wood.—Silver-gray stain, which is now very much in vogue, is prepared by dissolving 1 part of pyrogallic acid in 25 parts of warm water and the wood is coated with this. Allow this coating to dry and prepare, meanwhile, a solution of 2 parts of green vitriol in 50 parts of boiling water, with which the first coating is covered again to obtain the silver-gray shade.—Deutsche Maler Zeitung.

To Prepare Gold Varnish.—Dissolve 15 grammes of shellac and 1 gramme of turmeric in 330 grammes of spirit of wine, in the warm. The varnish is applied very evenly with a soft sponge in a downward direction and then from left to right. Silvering can be given a handsome gold shade thereby, and for tin plate this gold varnish is also very useful. If a more reddish tint of gold is desired a little dragon's blood should be added; if more yellow, the admixture of turmeric has to be increased.—Deutsche Maler Zeitung.

Cement for Glass Vessels.—A cement for glass vessels is obtained, according to the Sueddeutsche Apotheker Zeitung, by mixing together traumaticin, a saturated solution of bleached caoutchouc (or caoutchouc substances in chloroform) and concentrated water-glass solution. This combination effects a very energetic, firm adhesion of the fractures and has the advantage that the cementing appears transparent. The surrounding moisture of the atmosphere and other hydrous bodies do not exercise a dissolving action on the cement.

To Paint on Leather.—When the leather is finished in the tanneries it is at the same time provided with the necessary greasy particles, to give it the required pliancy and prevent it from cracking. It is claimed that some tanners strive to obtain a greater weight thereby, thus increasing their profit, since a pound of fat is only one-eighth as dear as a pound of leather.

If such leather, so called kips, which are much used for carriage covers and knee caps, is to be prepared for painting purposes, it is above all necessary to close up the pores of the leather, so that the said fat particles cannot strike through. They would combine with the applied paint and prevent the latter from drying, as the grease consists mainly of fish oil. For this reason an elastic spirit leather varnish is employed, which protects the succeeding paint coat sufficiently from the fat.

For further treatment take a good coach varnish, to which ¼ of stand oil (linseed oil which has thickened by standing) has been added and allow the mixture to stand for a few days. With this varnish grind the desired colors, thinning them only with turpentine oil. Put on two coats. In this manner the most delicate colors may be applied to the leather, only it is needful to put on pale and delicate shades several times.

In some countries the legs or tops of boots are painted yellow, red, green or blue in this manner.

Inferior leather, such as sheep skin and goat leather, which is treated with alum by the tanner, may likewise be provided with color in the manner stated. Subsequently it can be painted, gilded or bronzed.—From the German of J. H. Sommer, in the Deutsche Maler Zeitung.

Black Lakes for Wall Paper Manufacture.—Bluish-black lake.—Well boil 220 kilos of Domingo logwood in 1,000 liters of water to which 2 kilos of ammonia soda have been added; to the boiling logwood add next 25 kilos of green vitriol and then 3.5 kilos of solium bichromate. The precipitated logwood lake is whshed out well twice and then filtered.

Black Lake A. 1.—Logwood extract, Sanford, 120 kilos; green vitrol, 30 kilos; acetic acid, 7 deg. Bé, 10 kilos; sodium bichromate, 16 kilos; powdered alum, 20 kilos. The logwood extract is first dissolved in boiling water and brought to 25 deg. Bé by the addition of cold water. Then the remaining ingredients are added in rotation the salts in substance, finely powdered, with constant stirring. After the precipitation wash twice and filter.

Aniline Black Lake.—In the precipitating vat filled with 200 liters of cold water enter with constant stirring in the order mentioned the following solutions kept in readiness: 40 kilos of alum dissolved in 800 liters of water, 10 kilos of calcined soda dissolved in 100 liters of water, 30 kilos of azo black dissolved in 1,500 kilos of water, 600 grammes of "brilliant green" dissolved in 100 liters of water, 240 grammes of new fuchsine dissolved in 60 liters of water, 65 kilos of barium chloride dissolved in 1,250 kilos of water. Allow to settle for 24 hours, wash the lake three times and filter it.—Oesterreichische Farben- und Lack-Zeitung.

To Prevent Falling of Hair.—Twisselmann recommends the following remedy for falling hair in the Zeitschrift für Kosmetik. After the scalp has been washed in the evening with a mild soap and the addition of a little fat, such as lanolin or similar substance, and dried, the following mixture is applied to the moist scalp:

Spiritus rectificatissim	10 grammes
Acid tannic	5 grammes
Spiritus coloniens	2 grammes
Spiritus sinapis	10 grammes
Spiritus vini gallici	80 grammes

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Packing Shoes for Central America.—As a striking example of the lack of effort on the part of American manufacturers to capture and hold the trade of Central America I cite the following:

On Tuesday's mail steamer, there arrived here a representative of one of the largest shoe houses in the United States—a firm with some 4,000 employés.

On Wednesday morning, several good-sized orders were secured, prices and quality of goods being very satisfactory. In the afternoon, when he learned that shoes must be packed in burlap, he at once canceled all orders and left on Thursday for home.

He claimed that it would be too much trouble to pack in burlap; that they were accustomed to pack in cases, and did not know how to pack any other way.

Shoes pay a duty of $1.20 silver (48.3 cents) per kilogramme (2.2 pounds) gross weight, and as a case would weigh some 20 kilogrammes (44 pounds), it would mean $24 ($9.67) to be added to cost of shoes.—William E. Alger, Consul at Puerto Cortez.

Commercial Monopolies in Abyssinia.—Through private sources of information, I learn that a business depression exists in Abyssinia owing to an accumulation of stocks. There seems to be no immediate prospect of the sale of American goods in that Empire other than cottons, locally known as "aboudjedides," and petroleum. One recent order for American agricultural machinery has been placed by A. Savouré et Cie. of Addis-Ababa (Choa), by way of Djibouti, French Somaliland.

As far as trade in Abyssinia proper is concerned, there will be no competition for the next five years, as the house of Livierato Frères, of Marseilles and New York, has purchased the exclusive right to import cottons at the annual rate of 220,000 Marie Theresa thalers (about $103,000), plus the duty of 8 per cent, based upon the selling value in the country of importation. During the same period, the same concern has exclusive control of the return commerce in goat and sheep skins, paying for the same a tribute of 84,000 thalers ($39,480) per annum. My informant, who writes under date of June 16, says that this latter concession is deemed a poor one at the price.

The trade in petroleum is relatively unimportant, and is in the hands of natives, who buy their supplies at Aden.

As respects cottons, the mark of the camel is still the most highly esteemed in the Red Sea country. The sale of these cottons are in the hands of Benigha-Menaheim, at Aden. Livierato Frères have a number of marks, the favorites being the lion and head of Menelik.

These and other trade details are carefully studied by German exporting houses, who have their own German representatives among the natives, more particularly on the Asiatic side, and who aim by patient watchfulness to take a hand in trade whenever circumstances are favorable. The American policy is to do all the selling that is to be done in New York—a policy that cannot be said to have been a failure, certainly. Of course, the foreign houses have the advantage of being able to obtain cheap labor of an intelligent sort. Methodical office workers can be had in unlimited numbers at from 125 to 250 francs ($24.12 to $48.25) per month, the latter figure being decidedly above the average. Consequently, offers to take jobs in Asia and Africa at rather higher wages are readily taken. The Germans have a special aptitude for extending their commercial propaganda, always speaking the native dialect and often wearing the native garment.—Robert P. Skinner, Consul-General at Marseilles.

Live Stock in Cuba.—The department has received from Minister H. G. Squiers, of Habana, under date of July 17, 1902, translation of a message sent by President Palma to the Cuban Congress regarding changes in customs duties on live stock and on barbed wire, as follows:

REPUBLIC OF CUBA,
EXECUTIVE MANSION.

CONGRESS:

So imperious is the necessity of re-establishing the raising of live stock, the most natural and certain of all the resources of this country, that the Executive believes—and without prejudice to the direct aid which he proposes to ask of Congress for its encouragement and development—that private initiative should be stimulated by all possible means, furnishing it a way to enable it to contribute, under favorable circumstances, to the same end.

To demonstrate this necessity and the incalculable benefit which providing for it would bring to the country, the following considerations are, in the opinion of the Executive, sufficient:

(1) Of the 900,000 caballerias (30,000,000 acres) of which the land comprising the territory of this island is composed, 500,000 caballerias (16,600,000 acres) are at present uncultivated, for which reason they produce nothing. They are, however, adapted to the raising of cattle, and in them at least 4,000,000 head could be splendidly cared for, at the rate of 8 per caballeria (33 1-3 acres);

(2) Some 300,000 head being on an average the number consumed in the island in one year, when Cuba succeeds by the restocking of her cattle farms in producing the same, their value—reasonably estimated at $30* per head—would amount to $9,000,000, a sum which would remain in the country instead of going to the foreign lands from which such cattle are now obtained—and this aside from the $2,000,000 approximate value of the jerked beef at present consumed, aside from the value of the hides, which can be estimated at $1,500,000, and aside from the amount derived from cattle which could be exported to other countries from the surplus of Cuban stock; and

(3) Of the 400,000 head received throughout the island during the year, 200,000 should be sent to pasture before being slaughtered, according to reports from authentic sources. As lean cattle, in the six months' pasture which it requires to fatten, should, according to the estimates of competent persons, yield a profit of at least $10 to the cattleman for the greater weight obtained, it results that if these 200,000 head are brought in lean to be sent to pasture instead of coming in fattened for immediate slaughter, their fattening in this country would yield $2,000,000, which would be distributed among the cattlemen and planters; or, that is to say, by receiving them fattened the country would not enjoy this considerable profit, but it would go to increase the treasure of a few merchants and of the foreign raisers. However, while we are arriving at this longed-for result—that is, of producing in Cuba the number of cattle required for its consumption—it becomes indispensable to enact efficacious provisions directed not alone to the reproduction of this cattle, but to causing that which is received from the exterior, in the meanwhile, to yield a profit to the country before its slaughter, instead of obtaining it solely—as to-day happens in the majority of cases—with reference to fattened cattle. The Executive is consequently of the opinion that the thing to do is to amend the present customs tariffs to attain the end in view, as a principal means for stimulating private initiative in this matter; the customs tariffs in force to-day tending more to favor speculators than to protect the raising of cattle in Cuba. Under these tariffs (class 10, group 1) the duties paid on live stock on its importation into this island are the following:*

Paragraph 181.

Horses and mares:	Each.
(*a*) Those exceeding the established height	$10
(*b*) All others	5

Paragraph 182.

She mules	5

Paragraph 183.

Asses	5

Paragraph 184.

Cattle:	
(*a*) Oxen	2
(*b*) Cows	2
(*c*) Young oxen and cows	2
(*d*) Calves	1

In conformity with the foregoing, the Executive has the honor to submit to Congress' consideration, for the decision it may desire to adopt, the following bases:

The following scale shall govern the collection of tariff duties on cattle imported into this island at any one of the ports of Habana, Matanzas, Cardenas, Sagua la Grande, Nuevitas, Gibara, Cienfuegos, Tunas de Zaza, Santa Cruz del Sur, Manzanillo and Santiago de Cuba, the only ones equipped for the purpose. The following will enter free of tariff duties:

(1) Cows fit for breeding and heifers.

(2) Cows with their young, on foot.

(3) Bulls of the Jersey, Guernsey, Devon, Durham, Herefords, Porto Rico and Argentine Republic breeds, provided the importer duly* accredits their origin, states at the time of importation the ranch or farm to which they are destined, and guarantees that they will remain on the farm stated for the period of one year, under penalty of payment of the following duties:

	Each.
If guaranty is not given, each will be assessed	$15.00
Yearling calves	1.00
Fat cattle, male, from Florida, fat to be understood as not exceeding 550 pounds (253 kilogrammes) in weight	5.50
Fat cattle, male, from Honduras, fat to be understood as not exceeding 600 pounds (276 kilogrammes) in weight	6.00
Fat cattle, male, from Mexico, fat to be understood as not exceeding 700 pounds (322 kilogrammes) in weight	7.00
Fat cattle, male, from Venezuela and Colombia, or countries other than those mentioned, fat to be understood as not exceeding 800 pounds (368 kilogrammes) in weight	8.00
Lean cattle, or that weighing less than the above-mentioned weights, according to their origin	2.00

No lean cattle shall be slaughtered before at least three months after their landing. For this purpose they shall be branded on entry into the ports of the island with an iron or brand showing that they are for pasture. Before any cattle which may carry the mark referred to are slaughtered it shall be proven, in the manner which may be provided, that they have been in pasture for the period of three months mentioned. The slaughter of cows is prohibited, excepting those which may be useless for breeding, this to be properly proven. No new tax over those at present established, which might affect the consumption of cattle, shall in any form or for any purpose be collected during the period of three years. The present tariff is likewise amended with regard to horses and mules, and the following rules established:

Stallions exceeding the height established (150 centimeters—59 inches—measured by rule) and he asses shall enter free of duty.

	Each.
Mares exceeding the aforesaid height will pay	$4
Same, of less height	7
Geldings exceeding the aforesaid height	15
Same, of less height	5
Mules exceeding the established height	10
Same, of less height	5

For the period of one year, barbed wire and staples used in the construction of fences will be exempted from the payment of tariff duties.

The decision which Congress may adopt as a law will not take effect before ten days after its publication. The government will issue the orders and instructions necessary for the enforcement of what Congress may resolve, in case the preceding bases are approved.

THE PRESIDENT.

Habana, June 21, 1902.

International Exposition at Athens.—Mr. C. S. Wilson, chargé d'affaires of the legation at Athens, under date of July 5, 1902, sends notice of the International Exposition of Industry, Commerce, Art, and Hygiene to be held in Athens, beginning October 15, 1902. The wish is expressed that American products and industries may be represented. Copies of the rules and regulations of the proposed exposition are inclosed. The following extracts are taken from the regulations:

The general classification will include (1) fishing and fish culture, salt and fresh water fishing—stock and attributes; (2) salvage, fire, accidents on and under land and sea; (3) alimentation, manufactured products of all kinds; (4) sports and hunting; (5) articles of fashion and novelties; (6) hygiene, urban, of dwelling houses, bodily, industrial, medical arts; (7) locomotion, carriages, electro-motors, automobiles, bicycles; (8) industrial and decorative arts, fine arts; (9) industrial manufactures—extractive, chemical, textile, rubber, etc.; (10) liberal arts—photography, printing, book trade, instruments, scientific objects; (11) manufactories, machinery, agricultural products, forest cultivation, implements of husbandry, etc.; (12) social economy; (13) instruction, publicity, inventions, electricity, pyrotechnics, military art; (14) this group will include everything not classified in the above-mentioned groups.

The price of exhibition sites is fixed at 100 francs ($19.30) per square meter (1.196 square yards). Packages destined for the exposition are exempt from all customs duty and octroi. The maximum of food products will be 6.6 pounds for solids and six small bottles for liquids. Applications are to be addressed to the executive committee, Royal International Exposition of Athens, accompanied by half of the amount for cites and participation; the other half to be sent fifteen days after sending the exhibits. Efforts will be made to obtain transportation at reduced rates in the interest of exhibitors.

Imports into Colombia via Venezuela.—The following has been received from Mr. A. M. Beaupré, secretary of legation at Bogotá under date of June 4, 1902:

The disturbed condition of affairs between Colombia and Venezuela is having a most disastrous effect upon commerce in sections near the border line. Venezuela has closed the port of Maracaibo to Colombian articles of export and will not pass imports for Colombia without the payment of Venezuelan import duties. Until recently, while the payment of such duties was required, it was refunded upon the return of a consular certificate from Cucuta, the distributing point for that part of Colombia, showing the receipt of the goods. This has now been done away with, and goods brought in must pay duties at the custom houses of both Republics, which is prohibitive for most articles.

Demand for Drills and Tobacco Machinery in South Africa.—Consular Agent W. D. Gordon, of Johannesburg, under date of June 28, 1902, says that that agency has been asked to secure data in regard to drilling outfits, suitable for prospecting alluvial wash; a depth of 25 to 30 feet, and a core 6 inches or more in diameter is desired. He also has an inquiry re tobacco machinery and tobacco seed. Mr. Gordon adds:

If our merchants will forward information to this office, I will see that it is placed in the proper hands without delay.

American Pianos in Malta.—I have every reason to believe that Malta will eventually prove a good buyer of American pianos. Although the population is but a little less than 200,000, a great many pianos are used, the Maltese being experts in instrumental music. The instruments come from England, France and Germany, the average retail price being about $125. Of course, there are many instances in which higher-priced pianos are bought.

I have just received a letter from one of the foremost dealers and teachers in the islands, who in the course of a year has the opportunity to dispose of many instruments. He says:

"I sincerely trust you will be able to secure for me a connection as local representative of some piano manufacturer of good repute, who would be willing to send me a few instruments for sale on his account. I am sure I could soon dispose of them, if prices are reasonable. As you know, my clientele is made up of the aristocracy of the several communities here. My position is secure, and therefore all transactions will be perfectly safe. I am anxious to be the first to introduce American goods of this line into Malta."

The name of the writer of this letter may be secured from the Chief of the Bureau of Foreign Commerce, Department of State, Washington, D. C. Should anyone interested in the matter desire to see me personally, in order to gain further information, while I am on leave of absence in this country, my address may be obtained from the Department, and I shall be pleased to assist in any way that I can.—John H. Grout, Consul at Malta.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 1415. August 11.—The Express Train of the Future—Russia's Export of Poultry—Eastern Chinese Railroad Service—Projected Railroad in Asiatic Russia.

No. 1416. August 12.—Mineral Production of British Columbia in 1901—*The Chinese Language—Paper Industry of Germany in 1901.

No. 1417. August 13.—*Commercial Monopolies in Abyssinia—Convention of Sugar Producers of Brazil—Tariff on Furniture in Costa Rica—Customs Laboratories in Costa Rica.

No. 1418. August 14.—Balata Gum in Brazil—Brazilian Nut and Cacao Crops—New National School in Germany—Mica in French Guinea.

No. 1419. August 15.—New Pier at Port Limon, Costa Rica—Horse Breeding in Germany and France—*Packing Shoes for Central America—Italian Fruits in Germany.

No. 1420. August 16.—The Manufacture and Use of Briquettes in Germany—Brazilian Coffee Crop—Harvest of French Wine and Cider—Duty on Ether Sulphur in the Netherlands.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State Washington, D. C., and we suggest immediate application before the supply is exhausted.

*The present value of the Cuban dollar, or peso, is about 60 cents in United States currency.

*Paid in United States gold or its equivalent.

SELECTED FORMULÆ.

Stove Polish.

I.

Graphite	2 parts
Sugar	2 parts
Water	2 parts

II.

Graphite	1 part
Bone black	1 part
Copperas	2 parts

Add water sufficient to produce a pasty mass.—Druggists Circular and Chemical Gazette.

Lip Pomade.

VASELINE POMADE.

Vaseline oil, white	1,000 grammes
Wax, white	300 grammes
Geranium oil, African	40 grammes
Lemon oil	20 grammes

ROSE POMADE.

Almond oil	1,000 grammes
Wax, white	300 grammes
Alkannin	3 grammes
Geranium oil	20 grammes

YELLOW POMADE.

Vaseline oil, white	1,000 grammes
Wax, white	200 grammes
Spermaceti	200 grammes
Saffron surrogate	10 grammes
Clove oil	20 grammes

WHITE POMADE.

Vaseline oil, white	1,000 grammes
Wax, white	300 grammes
Bitter almond oil, genuine	10 grammes
Lemon oil	2 grammes

Ylang Ylang Perfume.—

Ylang ylang oil	10 minims
Neroli oil	5 minims
Rose oil	5 minims
Bergamot oil	3 minims
Alcohol	10 ounces

—Druggists Circular and Chemical Gazette.

Toilet Soap Powder.—

Marseille soap, powdered	10 kilos
Bran of almonds	500 grammes
Lavender oil	50 grammes
Thyme oil	30 grammes
Spike oil	20 grammes
Citronella oil	20 grammes

Iridia Perfume.—

Coumarin	10 grains
Concentrated rose water 1 to 40	2 ounces
Neroli oil	5 minims
Vanilla bean	1 drachm
Bitter almond oil	5 minims
Orris root	1 drachm
Alcohol	10 ounces

Macerate for a month.—Druggists Circular and Chemical Gazette.

Gardenia Soap.—

Soap stock	100 kilos
Brilliant orange	5 grammes
Linalool	100 grammes
Orchidin	80 grammes
Hyacinthin	50 grammes
Ylang ylang oil	20 grammes
Heliotropin	50 grammes
Ionon	25 grammes
Coumarin	50 grammes
Vanillin	50 grammes
Cananga oil	50 grammes
Tincture musk, genuine	100 grammes
Tincture styrax	200 grammes
Aubepine	10 grammes
Fragarol	20 grammes

—Seifensieder Zeitung, Augsburg.

King's Bouquet.—

Clove oil	10 minims
Bergamot oil	60 minims
Coumarin	10 grains
Conc't'd rose water (1 to 40)	1 ounce
Benzoin tincture	1½ drachms
Orris tincture	2 ounces
Bitter almond otto	5 minims
Alcohol	8 ounces

Macerate for a month.—Druggists Circular and Chemical Gazette.

Javanese Bouquet.—

Rose oil	15 minims
Pimento oil	20 minims
Cassia oil	3 minims
Neroli oil	3 minims
Clove oil	2 minims
Lavender oil	60 minims
Sandalwood oil	10 minims
Alcohol	10 ounces
Water	1½ ounces

Macerate for fourteen days.—Druggists Circular and Chemical Gazette.

Iranian Essence.—

Bergamot oil	20 minims
Lavender oil	30 minims
Clove oil	20 minims
Sandalwood oil	30 minims
Bitter almond oil	15 minims
Rose oil	25 minims
Coumarin	10 grains
Alcohol	10 ounces

Macerate for a week or more.

Lilac Water.—

Terpineol	2 drachms
Heliotropin	8 grains
Bergamot oil	1 drachm
Neroli oil	8 minims
Alcohol	12 ounces
Water	4 ounces

—Druggists Circular and Chemical Gazette.

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